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THESIS

PROMOTION FACTORS FOR ENLISTED INFANTRY MARINES

by

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June 2017

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PROMOTION FACTORS FOR ENLISTED INFANTRY MARINES

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

The Marine Corps dedicates itself to ensuring quality retention and promotion. To accomplish this, we must analyze the effects of policy and the quality of Marines currently serving. This thesis considers data from 97,013 enlisted infantry Marines who entered the Marine Corps from 2001 to 2016 to determine which factors contribute toward promotion for the ranks of lance corporal, corporal, sergeant and staff sergeant. To assess which ranks proportionally promote more high-quality Marines, we compare two performance evaluation methods: proficiency and conduct marks and reporting senior and reviewing officer values.

Our analysis of the data shows that the most important factors for promotion are conduct scores, reporting senior relative values, the number of deployments, combat fitness test (CFT) and physical fitness test (PFT) scores and zero adverse fitness reports. From the two performance evaluation methods we find that the Marine Corps promotes proportionally more high-quality Marines as reflected in fitness reports than with proficiency and conduct marks.

Promoting and retaining the highest-performing Marines will ensure they are fully prepared to meet current and future challenges to national security. We must develop new methods for retaining more top-quality Marines to ensure their greatest probability of success.

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LIST OF ACRONYMS AND ABBREVIATIONS

1stSgt	first sergeant
CART	classification and regression tree
CFT	combat fitness test
CPL	corporal
FITREP	fitness report
GySgt	gunnery sergeant
GT	general technical
IRAM	individual records administration manual
IST	initial strength test
LCpl	lance corporal
MBS	master brief sheet
MGySgt	master gunnery sergeant
MMSB	Manpower Management Support Branch
MOS	military occupational specialty
MSgt	master sergeant
PEBD	pay entry base date
PES	performance evaluation system
PFC	private first class
PFT	physical fitness test
PII	personally identifiable information
PVT	private
RO	reviewing officer
ROCV	reviewing officer cumulative value
RS	reporting senior
RSRV	reporting senior relative value
Sgt	sergeant
SgtMaj	sergeant major
SSgt	staff sergeant
TFDW	Total Force Data Warehouse
USMC	United States Marine Corps

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EXECUTIVE SUMMARY

Promoting and retaining high-quality Marines is a priority for the Marine Corps. However, due to periods of growth during two major conflicts, quality has given way to quantity to fulfill the needs of the Marine Corps. As conflicts draw down, the Marine Corps shifts from promoting and retaining quantity to high-quality Marines. Throughout this thesis, we use classification trees to determine which factors influence probabilities of promotion for enlisted infantry Marines across four ranks: lance corporal to corporal, corporal to sergeant, sergeant to staff sergeant, and staff sergeant to gunnery sergeant. We then identify the proportion of Marines promoted by performance levels (quadrants) and the probability of promoting from each quadrant. Finally, the thesis compares two performance evaluation methods (proficiency and conduct marks vs. fitness report values) to determine which method proportionally results in the promotion of more top performing Marines.

From Table ES-1, we observe the three important factors that influence probabilities for Marines promoting and not promoting (indicated by the level at which the factor splits into two groups or branches). The dominant categories are performance evaluation (proficiency and conduct marks, reporting senior and reviewing officer values), the number of deployments, physical fitness (combat fitness test [CFT] and physical fitness test [PFT] scores), adverse fitness reports and the number of personal awards. For the ranks of lance corporal and staff sergeant, we observe median conduct marks and reporting senior relative values, respectively, to be the most important factors throughout the classification trees. While for corporals and sergeants, we observe that the number of deployments are the most important factors. Across all of the ranks we observe median CFT scores branch between 283 and 290 while median PFT scores branch from 239 to 265. For the ranks of lance corporal and corporal, the median proficiency and conduct scores both branch at the 4.3 mark. For sergeant and staff sergeant fitness reports, we observe that the median reporting senior relative values branch at 90 (in a range from 80 to 100) and median reviewing officer cumulative values branch at values between .17 and 0.44 (range -5 to 4). Both of these indicate below-

average and above-average groups. We also observe that adverse fitness reports significantly decrease probabilities for promotion.

Table ES-1. Important Factors that Contribute to Promotion by Rank

Conclusions: Most Important Factors for Promotion					
Rank (# Marines)	Lance Corporal (31312)	Corporal (26840)	Sergeant (7893)	Staff Sergeant (773)	
Greatest Probability for Promoting	81% Conduct > 4.3	49% Deployment > .5	43% Deployments > .5	62% RSRV > 90	
	86% PFT > 240	95% Conduct > 4.3	58% RSRV > 90	69% CFT > 290	
	96% Deployments > .5		62% Adverse < .5	78% Deployments > 4	
Least Probability for Promoting	53% Conduct < 4.3	24% Deployments < .5	3% Deployments < .5	18% RSRV < 90	
	36% Conduct < 4.2	15% Conduct < 4.5	21% RSRV < 90	8% CFT < 292	
	20% PFT < 263	11% PFT < 265	5% Adverse > .5	2% Adverse > .5	

We then group each Marine by rank into four performance levels (quadrants) by using proficiency, conduct, reporting senior relative values and reviewing officer cumulative values. From these we calculate the proportion of Marines promoted from each performance quadrant. As observed in Figure ES-2, we note that the Marine Corps promotes a low proportion of enlisted infantry Marines from the top performing quadrants when using proficiency and conduct for performance evaluation. Conversely, the Marine Corps promotes proportionally more top-performing Marines when using reporting senior relative values and reviewing officer cumulative values for performance evaluation.

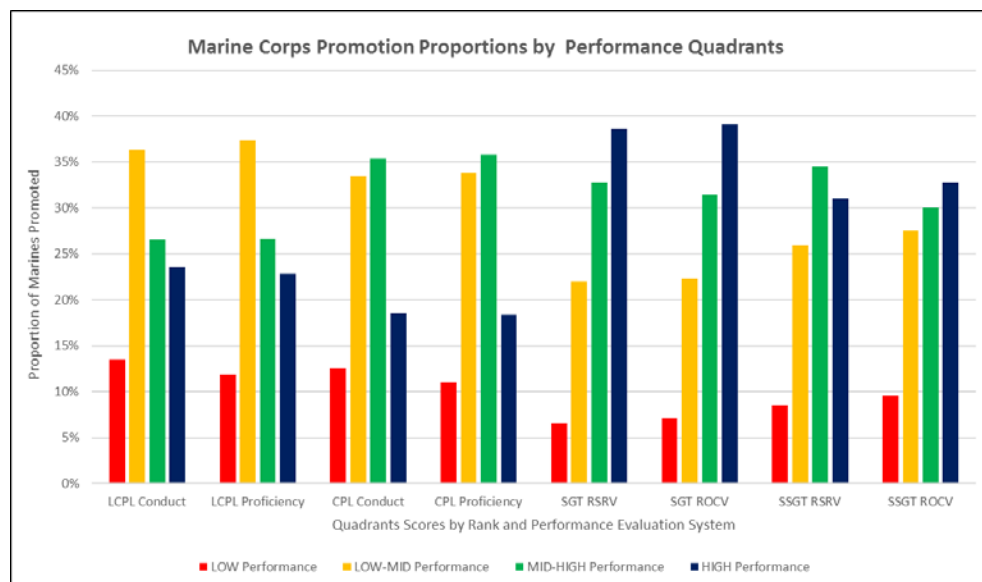


Figure ES-2. Proportions of Enlisted Infantry Marines Promoted

Next we calculate estimated probabilities from our models to classify each Marine as either a promoting or not promoting for each rank. We first randomly select 10% of Marines (the test set) and save them for later. We then run the classification model with the 90% of Marines (training set) to create the model. Then we determine a threshold between the Marines that promote and do not promote. We then compute truth tables using our test set to determine the level at which our model accurately classified the Marines in the test set. We do this with two models for each rank (with performance and without performance factors) to determine the necessity of having performance included.

A. RECOMMENDATIONS

To ensure the Marine Corps retains and promotes the highest-quality Marines, it is necessary to identify them from among the top-performing quadrants. We observe that the proportion of top-performing Marines getting out of the Marine Corps is higher than reasonably expected. We believe that a reasonable proportional split for quality retention and promotion is achieved through a quadrant breakdown of 50%, 30%, 18% and 2% of Marines from high, mid-high, mid-low and low- performing quadrants respectively. Putting 80% of Marines above average and allowing 20% to retain and promote from the below-average Marines. Through our analysis, we discover that it is not possible to split the data evenly into quadrants, indicating that the range of 0 to 5 is not being utilized fully and that precise guidance will create more usable and distinguishable performance categories.

From the models, we observe important branching from the year of entry as a result of wartime structure growth. This indicates probabilistic dominance created from widening the promotions zones (a result of degrading every factor for all Marines in favor of increasing the number of eligible Marines). We believe that a better method of retention is to identify top-performing Marines and incrementally influencing their retention options when needed. Further, we believe that the Marine Corps should identify Marines that require less oversight (by using lifetime data for each Marine) to retain and promote those that consistently demonstrate the ability to self-develop.

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I. INTRODUCTION

Marines have historically possessed an innate drive to succeed, to excel in all that they do, including winning in combat. We will sustain this trait and ensure this drive to succeed, excel, and win continues to define our Corps by maintaining a force of the highest quality, which is smart, resilient, fit, disciplined, and able to overcome adversity. Recruiting and retaining quality men and women of character in today's Corps is our friendly center of gravity and our highest priority.

—Robert B. Neller (2016)

A. BACKGROUND

1. Backbone of the Marine Corps

The backbone of the United States Marine Corps (USMC) is the infantry battalion. The primary mission of the infantry battalion is “to locate, close with, and destroy the enemy by fire and maneuver or to repel his assault by fire and close combat” (United States Marine Corps [USMC] 2000). An infantry battalion is composed primarily of enlisted infantry Marines. Within an infantry battalion there are five companies: a Headquarters and Service Company, a Weapons Company and three Infantry Line Companies. Within each line company there are about 176 enlisted Marines ranging in ranks from private (PVT) to first sergeant (1stSgt). Each enlisted Marine's performance is evaluated routinely and recorded. In addition to performance evaluations Marines complete training in accordance with their military occupational specialty (MOS). Within the infantry there are multiple MOSs. During initial training an infantry Marine holds the 0300 MOS (basic infantryman). Upon completion of the relevant initial training, a Marine will check into his first infantry battalion and possess one of the following MOSs: 0311-infantryman, 0317-scout sniper, 0331-machinegunner, 0341-mortarman, 0351-infantry assaultmen, or 0352 antitank missilemen.

2. Ranks Associated with Proficiency and Conduct Marking

In the USMC each enlisted Marine has both a rank and a paygrade. The ranks range from private to sergeant major. An enlisted Marine first enters the Marine Corps at the rank of private and after attending boot camp a Marine will typically promote to

private first class (PFC). Within their first year in an infantry battalion a Marine will likely be promoted to the rank of lance corporal (LCpl). With a minimum time in grade of twelve months a lance corporal can promote to corporal (Cpl). Ideally a Marine will have deployed at least one time within a battalion before their first enlistment has expired.

An enlistment is the contractual period for which a person signs with the Marine Corps committing him or her to service. A typical first enlistment period is four to six years depending on the needs of the Marine Corps. Within a year of the enlistment period expiring a Marine is eligible to submit a reenlistment package to request a second enlistment.

During the entirety of the first enlistment, but prior to promoting to sergeant (Sgt), a Marine receives a proficiency and conduct assessment. Once a Marine meets minimum time in service of at least 24 months and time in grade as a corporal of at least 12 months, the Marine is eligible for promotion to the rank of sergeant.

3. Proficiency and Conduct Marking

An enlisted Marine from the rank of private through corporal receives a proficiency and conduct assessment semi-annually on 31 January and 31 July. Each assessment score ranges from 0.0 to 5.0 in accordance with Tables 1 and 2 taken from the Individual Records Administration Manual (IRAM) (USMC 2000).

a. Proficiency Assessment

Proficiency marks are provided by the commander to evaluate “the whole Marine concept” which includes attributes such as “mission accomplishment, leadership, intellect and wisdom, individual character, physical fitness, personal appearance and completion of professional military education” (USMC 2000). The proficiency mark is a portion of the evaluation score that factors into a Marine’s composite score for the ranks lance corporal and corporal. A Marine receives a percentage of points based on his or her proficiency score, with higher scores indicating better performance.

Table 1. Standards of Proficiency. Source: USMC (2000).

MARK	CORRESPONDING ADJECTIVE RATING	STANDARDS OF PROFICIENCY
0.0 to 1.9	Unacceptable	Does unacceptable work in most duties, generally undependable; needs considerable assistance and close supervision on even the simplest assignment.
2.0 to 2.9	Unsatisfactory	Does acceptable work in some of the duties but cannot be depended upon. Needs assistance and close supervision on all but the simplest assignments.
3.0 to 3.9	Below Average	Handles routine matters acceptably but needs close supervision when performing duties not of a routine nature.
4.0 to 4.4	Average	Can be depended upon to discharge regular duties thoroughly and competently but usually needs assistance in dealing with problems not of a routine nature.
4.5 to 4.8	Excellent	Does excellent work in all regular duties, but needs assistance in dealing with extremely difficult or unusual assignments.
4.9 to 5.0	Outstanding	Does superior work in all duties. Even extremely difficult or unusual assignments can be given with full confidence that they will be handled in a thoroughly competent manner.

b. Conduct Assessment

Conduct marks are also provided by the commander to evaluate a Marine's "conformance to accepted usage and custom and positive contributions to the Marine Corps" (USMC 2000). Conduct markings also include the commander's assessment of a Marine's "general bearing, attitude, interest, reliability, courtesy, cooperation, obedience, adaptability" (USMC 2000). The conduct mark is an additional factor that comprises a Marine's composite score.

Table 2. Standards of Conduct. Source: USMC (2000).

MARK	CORRESPONDING ADJECTIVE RATING	STANDARDS OF CONDUCT
0.0 to 1.9	Unacceptable	Habitual offender. Conviction by general, special, or more than one summary court-martial. Give a mark of "0" upon declaration of desertion. Ordered to confinement pursuant to sentence of court-martial. Two or more punitive reductions in grade.
2.0 to 2.9	Unsatisfactory	No special court-martial. Not more than one summary court-martial. Not more than two nonjudicial punishments. Punitive reduction in grade.
3.0 to 3.9	Below Average	No court-martial. Not more than one nonjudicial punishment. No favorable impression of the qualities listed in paragraph 4007.6a. Failure to make satisfactory progress while assigned to the weight control or military appearance program. Conduct such as not to impair appreciably one's usefulness or the efficiency of the command, but conduct not sufficient to merit an honorable discharge.
4.0 to 4.4	Average	No offenses. No unfavorable impressions as to attitude, interests, cooperation, obedience, after-effects of intemperance, courtesy and consideration, and observance of regulations.
4.5 to 4.8	Excellent	No offense. Positive favorable impressions of the qualities listed in paragraph 4007.6a. Demonstrates reliability, good influence, sobriety, obedience, and industry.
4.9 to 5.0	Outstanding	No offenses. Exhibits to an outstanding degree the qualities listed in paragraph 4007.6a. Observes spirit as well as letter of orders and regulations. Demonstrates positive effect on others by example and persuasion.

4. Ranks Associated with the Fitness Report Assessment

Once a Marine promotes to the rank of sergeant, that Marine is subject to the performance evaluation system (PES) which uses the fitness report (FITREP) for performance evaluation. To achieve the rank of sergeant a Marine typically has at least four years-time in service, two deployments and is the early stages of their second

enlistment. In an infantry battalion a sergeant generally holds the billet of squad leader and is in charge of the daily mentoring, development, and leadership of the thirteen Marines in his squad. The next opportunity for promotion is to the rank of staff sergeant (SSgt). A staff sergeant typically has eight to twelve years of experience in the Marines Corps and holds the billet of platoon sergeant, who advises the platoon commander and supervises the development of approximately 40 Marines within the infantry platoon. After about two deployments in an infantry battalion a staff sergeant will receive professional military education at a formal school house and be ready to promote to the rank of gunnery sergeant (GySgt). Typically, a gunnery sergeant has twelve to sixteen years of service and advises the company commander on the tactical employment of unit. The next opportunity to promote is to either master sergeant (MSgt) or first sergeant (1stSgt). The highest ranks in an infantry battalion are a master gunnery sergeant (MGySgt) promoted from master sergeant or a sergeant major (SgtMaj) promoted from the first sergeant rank. For the ranks of sergeant and above performance is evaluated using fitness reports in the performance evaluation system (PES). From Table 3 we observe the full rank structure in seniority descending order.

Table 3. USMC Enlisted Grade Structure. Source: USMC (2000).

<u>Grade</u>		<u>Pay Grade</u>
Sergeant Major	(SgtMaj)	E-9
Master Gunnery Sergeant	(MGySgt)	E-9
First Sergeant	(1stSgt)	E-8
Master Sergeant	(MSgt)	E-8
Gunnery Sergeant	(GySgt)	E-7
Staff Sergeant	(SSgt)	E-6
Sergeant	(Sgt)	E-5
Corporal	(Cpl)	E-4
Lance Corporal	(LCpl)	E-3
Private First Class	(PFC)	E-2
Private	(Pvt)	E-1

5. Fitness Report Evaluation Process

The fitness report is a performance evaluation that each Marine above the rank of sergeant receives annually or during periods of significant change. Typically, a Marine will receive an observed fitness report for periods greater than three months by their

immediate supervisor, referred to as the reporting senior (RS). In addition to the RS evaluation, each Marine also receives evaluation on the same fitness report from a reviewing officer (RO). For example, a sergeant whose billet is that of squad leader will have an RS that is the platoon commander and an RO who is the company commander. If either the RS or RO have insufficient observation time (less than three months) the fitness report will still be completed but marked as not observed due to insufficient observation time for that evaluator.

The fitness report is composed of the following sections: administrative, billet description, billet accomplishments, mission accomplishment, individual character, leadership, intellect and wisdom, fulfillment of evaluation, RS directed comments, certification, RO comments and an RO ordinal tree “Christmas Tree” assessment. In addition to the directed comments from the RS and RO each fitness report creates an RS relative cumulative value (RSRV) and an RO cumulative value (ROCV). The RSRV ranges from 80 to 100. It is broken into thirds on the master brief sheet (MBS) to show across all reports where each Marine falls out against their peers as being above, with, or below others in standing. The ROCV uses the RO “Christmas Tree” which has values one to eight with one being unsatisfactory and eight being eminently qualified. Figure 1 shows a blank RO “Christmas Tree” used for computing the ROCV. A Marine’s overall ROCV will also break into thirds; above, with or below their peers. The ideal Marine is above peers from his or her RS and above peers from his or her RO.

DESCRIPTION	COMPARATIVE ASSESSMENT	
THE EMINENTLY QUALIFIED MARINE	☐	
ONE OF THE FEW	☐	
EXCEPTIONALLY QUALIFIED MARINES	☐	
ONE OF THE MANY HIGHLY QUALIFIED	☐	
PROFESSIONALS WHO FORM THE	☐	
MAJORITY OF THIS GRADE	☐	
A QUALIFIED MARINE	☐	
UNSATISFACTORY	☐	

Figure 1. Reviewing Officer “Christmas Tree.” Source: USMC (2000).

6. Master Brief Sheet and its Use on a Promotion Board

The master brief sheet is a document that captures each Marine's performance profile and includes all fitness reports, RSRV, ROCV and how each Marine compares to his or her peers. The breakdown of where a Marine falls out against their peers allows members of the promotion board to quickly brief the Marine's performance in the two-minute window allocated for each Marine. Additional information that will be briefed is combat fitness test (CFT) score, physical fitness test (PFT) score, number of awards, number of deployments, leadership billets, rifle qualification, primary military education completed, additional schools attended, adverse information, and any additional material the Marine may have submitted to the board. Ultimately the master brief sheet allows a member of a promotion board to quickly assess the performance of a Marine by categorizing their performance quickly.

B. PURPOSE OF THE THESIS

An enlisted Marine is evaluated under two different performance evaluation systems. Although the performance evaluation system is necessary and efficient it is important for individual Marines to know and fully understand what their chances of promoting are prior to a promotion board. For the first few years Marines are evaluated by receiving proficiency and conduct marks which contribute toward a composite score. After promoting to sergeant a Marine receives fitness reports in accordance with the performance evaluation system and when eligible will be briefed on a promotion board. The Marine Corps tracks information on each Marine for promotion and retention purposes.

The purpose of this thesis is to provide the Marine Corps an alternate perspective for viewing quality (i.e., the proportion of quality Marines from each of four quadrants). We also seek to provide enlisted infantry Marines and their leadership an understanding of how individual factors affect the likelihood of retention and promotion. Classification and regression trees can identify important factors and their associated levels that contribute to increasing probabilities of promotion for each rank. Gaining a deeper understanding of factor influence will show the results that policy has developed.

Understanding factor importance will also provide enlisted infantry Marines with the information they should know about what the Marine Corps requires of them in order to promote at each rank.

C. RESEARCH QUESTIONS

1. Primary Research Question

What variables are important factors in predicting promotion for enlisted infantry Marines to corporal, sergeant, staff sergeant and gunnery sergeant?

2. Secondary Research Questions

What proportion of Marines does the Marine Corps promote from the bottom, lower-middle, upper-middle and top fourths by rank and year with respect to proficiency and conduct scores and reporting senior relative values and reviewing officer cumulative values?

How do proficiency and conduct evaluations compare to the reporting senior relative values and reviewing officer cumulative values as predictors for retention and promotion.

D. SCOPE AND LIMITATIONS

1. Scope

The scope of this research includes a review of existing performance and promotion directives, a statistical review of the data from the Total Force Data Warehouse (TFDW) and the Manpower Management Support Branch (MMSB), a detailed description of the data handling method used, the method used for factor prediction, the results of the classification trees and recommendations based off the results. We use four ranks for the base of the study; lance corporal, corporal, sergeant and staff sergeant. The outcome variable is promotion to subsequent rank.

2. Limitations

The period of research spans the years 2001 to 2016 and during that time some policies have changed; namely the CFT was initiated en masse in 2009. Since half of the data collected has missing values for the dates prior to 2009 the method for interpretation uses tree analysis. Existing regression models do not handle missing data very well, due to this limitation some observations were discarded.

E. ORGANIZATION OF THE THESIS

This thesis is organized into five chapters. Chapter I provides a background overview and the purpose of this thesis. Chapter II is a literature review which focuses on methods used for classifying promotions using performance measures. Chapter III discusses the data collection and cleaning process and the analysis methods used throughout the study. Chapter IV details the results from the study by rank. Chapter V outlines conclusions, recommendations and future work.

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II. LITERATURE REVIEW

A. INTRODUCTION

While a number of papers have been written about officer promotion predictors and retention in the United States Marine Corps, few have been done for the enlisted side. A Center for Naval Analyses (CNA) study (Clemens et al. 2012) takes a wide view of officer retention and their associated significant prediction factors toward promotion. Garza (2014) identifies individual factors that become significant predictors during the career designation boards for junior officers. Hoffman (2008) specifically looks at predictors for promotion of field grade officers. Larger (2016) provides a succinct overview of promotion methods used across the military and through industry which lays a foundation for viewing proportional performance promotions. We discuss each of these studies separately in the following sections. It should be noted that none of these studies have considered analysis for the USMC enlisted community.

B. CENTER FOR NAVAL ANALYSES STUDY

The study of Clemens et al. (2012) on the Marine Corps' officer fitness report system analyzes the fitness report system to answer questions about fitness report inflation, changes to the process due to experience, the significance of the reporting senior and reviewing officer values over time, verbal and numeric marking comparisons and processes for improvement. The report finds that the individual fitness report marks and verbal comments are consistent to one another. It also concludes that those promoted are generally consistent with higher reporting senior and reviewing officer marks.

C. GARZA STUDY

Garza (2014) applies a probit regression model to predict the probability of a Marine being career designated. He finds that a Marine's reviewing officer relative value average is consistently the most significant predictor of career designation. He also finds that the number of combat deployments did not produce significant prediction results toward career designation. His analysis considers 6,732 officers from the 2010 career

designation board. The prediction model used 96 explanatory variables pulled from three separate Marine Corps databases.

D. HOFFMAN STUDY

Hoffman's (2008) thesis considers factors that predict an officer's probability for promotion to major, lieutenant colonel, and colonel in the Marine Corps. The author uses data from the Total Force Data Warehouse (TFDW) and the Manpower Management Support Branch (MMSB) which results in 56 prediction variables across three ranks. The author analyzes data from 1,435 officers that were ready for promotion ("in zone") during fiscal year 2008. Hoffman finds that the results vary among the three ranks. For major the significant predictors for promotion are marital status, PFT, water qualification, reporting senior value, reviewing officer value, personal awards and billet assignments. Significant predictors for lieutenant colonel promotion include the same predictors for promotion to major as well as commissioning source. For promotion to colonel duration of time as a major, commissioning program, reporting senior relative value average, reviewing officer average and standard deviation and billet assignment proved significant.

E. LARGER STUDY

Lager's (2016) study of junior enlisted Marines has an interesting literature review that covers multiple promotion methods. His review considers internal labor markets with "Firm-Specific Human Capital" (specifically "limited entry and exit points" and "wage allocation") and identifies a promotion method used for corporate organizations known as the "tournament model." This model promotes individuals on a competitive premise from amongst performance tiers. While the "tournament model" appeals to an objective performance based promotion process it can also reduce cooperation amongst individuals. This particular model reflects the promotion process observed in the Marine Corps. For a full survey of this literature see Lager 2016.

F. SUMMARY

While there has been substantial work on identifying prediction variables for Marine Corps officer promotion, analyses of promotion of enlisted Marines are sparse.

Binary regression models are commonly used for identifying significant factors toward promotion. The common significant predictors from the above mentioned studies are fitness report scores, combat fitness test scores, physical fitness test scores, number of combat deployments, type of billet assignments and awards. Analysis across multiple cohorts has been conducted for officer ranks but not for those of the enlisted community. We combine the efforts and methods used in predicting officer promotion to analyze similar conditions for the enlisted infantry community. We then compare proportional performance promotions using a tournament style model.

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III. DATA DESCRIPTION

A. DATA COLLECTION PROCESS

We retrieved the data for the thesis research from the Total Force Data Warehouse (TFDW) and Manpower Management Support Branch (MMSB). The data retrieval process required approval from the Naval Postgraduate School's Institutional Review Board and the USMC Institutional Review Board to preserve personally identifiable information (PII). To further protect each Marine's identity TFDW generated an individual randomized number, which is used to synchronize the two data sources. We protect the data on a secure network with limited access.

B. DATA COMPOSITION

We use data from only enlisted infantry Marines entering the Marine Corps from 2001 to 2016. The data consists of records from 97,013 male Marines (historically an all-male force) and contains 172 variables. We segment the data by rank with a focus on promotion from lance corporal to corporal, corporal to sergeant, sergeant to staff sergeant and staff sergeant to gunnery sergeant. Table 4 lists the predictor variable that are used in this study.

Table 4. Variables Used for Preparing Predictor Categories

<u>Variables</u>	<u>Brief Description of Variables</u>
ID	Randomly generated identification number used to combine data from two systems
Current Rank	Ranks used for analyses (Lance Corporal, Corporal, Sergeant, Staff Sergeant)
Pay Entry Base Date	Date a Marine began enlistment into USMC
Next Rank	Next rank a Marine earned
Next Rank Date	Date the Marine picked up the next rank
Proficiency Value	Semi annual Proficiency grade for Marines below rank of Sergeant
Conduct Value	Semi annual Conduct grade for Marines below rank of Sergeant
Reporting Senior Relative Value	Marines FITREP Value from their immediate Supervisor
Reviewing Officer Cumulative Value	Marines FITREP Value from their secondary Supervisor
Physical Fitness Test Scores	Annual physical test: 3 mile run, pull-ups, and sit-ups in two minutes
Combat Fitness Test Score	Annual physical test: Manuever Under Fire, Movement to Contact, Ammo Can Lift
Rifle Qualification Score	Annual rifle qualification (Marksman, Sharpshooter, Expert, UNK)
End of Active Service (EAS) date	Date a Marine terminated contract with the Marine Corps
Awards	Type and Number of Awards a Marine has earned
Waivers	Waivers required for each Marine upon entry into USMC
Deployment	The number of deployments a Marine has participated in
GT scores	General Technical score from the ASVAB

C. DATA DEVELOPMENT PROCESS

To prepare the data for use in estimating classification models we create four data sets, aligned to the four promotion steps of interest, with each Marine represented as one record. Because each Marine has multiple values for some factors it is necessary to consolidate them into a single value. For instance, each Marine has multiple PFT scores because it is an annually graded event.

With performance and physical fitness values across multiple occasions the median is used to summarize a Marine's overall value. The median is often preferred to the mean as it is less prone to the effects of outliers. For example, if a Marine has a series of strong fitness reports and one negative report, the median is less affected by the negative report than the mean. This method is applied to the performance and fitness values of all Marines.

D. GENERAL RESTRICTIONS APPLIED TO EACH DATA SET

For each rank considered (lance corporal, corporal, sergeant and staff sergeant) we study only those Marines that have been in the Marine Corps long enough to be a candidate for promotion. For instance, a sergeant with only one year in grade has not had enough time to be eligible for promotion. To prevent these Marines from skewing the data we exclude them from the analysis. A result of this process is that the lance corporal data set includes those Marines that entered the Marine Corps from 2001 to 2011, corporals from 2001 to 2010, sergeants from 2001 to 2007 and staff sergeants from 2001 to 2004.

It also is necessary to ensure that data inclusion is restricted to events that led up to each promotion board but not future information. We do this to prevent entries such as fitness reports values from a Marine's time as a staff sergeant from being included in the prediction model for promotion to sergeant. With the data partitioned by rank, and only applicable entries included for those with enough time in grade, we then prepare the variables for use in our classification model.

E. PREDICTOR VARIABLE DEVELOPMENT

All predictor variables are calculated using software from the R statistical programming language (R Core Team 2016) and we use the following R packages for data cleaning: **plyr** (Wickham 2011), **dplyr** (Wickham et al. 2016), and **tidyr** (Wickham 2011). We use these three packages for data cleaning purposes, specifically removing duplicate data entries, and for providing median outputs from multiple observations.

We extract the year of entry from each Marines Pay Entry Base Date (PEBD) and we use it as a variable to account for force structure changes in the Marine Corps from 2001 to 2011. Table 5 shows the number of enlisted Marines by rank and year using their PEBD. Table 5 shows a decreasing trend in the number of Marines by rank. This is a result of the data collection process which includes only Marines joining the Marine Corps after 2001. The final years listed by rank are a sample vice the entire rank population due to data trimming in the later years to ensure that each Marine has had the opportunity to be eligible to promote. We exclude analysis from Marines that entered after 2011 as a result of promotion ineligibility.

Table 5. Analyses Data Composition by PEBD and Rank

Total Marines in Analyses by PEBD Year and Rank				
<u>PEBD Year</u>	<u>LCPL</u>	<u>CPL</u>	<u>SGT</u>	<u>SSGT</u>
2001	2446	2976	1207	364
2002	4081	3890	1592	269
2003	4572	3930	1872	119
2004	3758	3508	1796	45
2005	3398	2910	982	
2006	1912	2060	308	
2007	2835	2798	110	
2008	3281	2839		
2009	3019	1530		
2010	1668	355		
2011	341			

Next we consolidate the awards variable from more than 40 types of awards into five categories. We create five individual category variables according to whether a Marine received a purple heart, high personal award, personal award, combat distinguishing device, or combat action ribbon. A purple heart is typically received for being wounded in combat. The high personal award category is the composition of all awards at the level of bronze star and above. Personal awards are mostly those awards at commendation and achievement level. Table 6 shows the breakdown of each of these awards. The combat distinguishing device is earned typically for valorous action and the combat action ribbon is earned for executing duties during a period of physical combat.

It is possible for a Marine to receive more than one of these awards. Each of the five category variables records the number of the respective awards received. For example, a Marine with two personal awards receives a value of “2” under the P_AWD variable.

Table 6. Five Categories of Awards Used for Classification

"HP_AWD"	<u>High Personal Award</u> Navy Cross Distinguished Service Medal Silver Star Navy and Marine Corps Medal Bronze Star Defense Meritorious Service Air Medal
"P_AWD"	<u>Personal Award</u> Meritorious Service Medal Joint Commendation Service Commendation Medal Joint Achievement Medal Service Achievement Medal
"PH"	<u>Purple Heart</u>
"CAR"	<u>Combat Action Ribbon</u>
"V"	<u>Combat Distinguishing Device</u>

A quick statistical analysis of the number of awards earned by rank, as detailed in Table 7, reveals an interesting finding at the rank of lance corporal. When comparing the number of personal awards against the number of purple hearts received we find that the ratio for lance corporal is 23% vice the 4% for staff sergeant. While purple hearts become less frequent with increasing rank, personal awards become more frequent. We also observe that staff sergeant “High Personal Awards” are received four times more often than for any other rank.

Table 7. Enlisted Infantry Award Categories by Rank

Enlisted Infantry Awards by Rank								
(Total Marines in Data Set)	Lance Corporal (31312)		Corporal (26840)		Sergeant (7893)		Staff Sergeant(773)	
Award Category	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Purple Heart	4904	16%	3572	13%	324	4%	38	5%
Personal Award	21214	68%	19521	73%	5520	70%	948	123%
High Personal Award	322	1%	316	1%	110	1%	33	4%
Combat Distguishinig Device	4942	16%	4511	17%	1161	15%	159	21%
Combat Action Ribbon	40636	130%	28794	107%	1855	24%	203	26%
Purple Heart / Personal Award	23%		18%		6%		4%	

The initial strength test (IST) score is derived from the IST test taken by each candidate recruit upon enlistment into the Marine Corps. It is composed of a 1.5 mile timed run portion, timed sit-ups and the number of pull-ups conducted. Scoring is different for male and female recruits but this study uses purely male standards as only male Marines were allowed in the infantry until 2016. In the absence of an IST score system the PFT scoring method is used. To get 100 points on the male PFT for the run portion a Marine must run at a pace of six minutes per mile for three miles. To achieve a maximum score in sit-ups a Marine must do 100 sit-ups in two minutes. To get a perfect score for pull-ups a male Marine must complete 20 pull-ups (USMC 2008a). From these standards and in the absence of an IST score calculator, each Marines score is normalized by penalizing run times over six minutes per mile. This is done by giving each Marine candidate a score of 100 for the run, subtracting total seconds over six minutes and multiplying by one third (three seconds per point), similar to the PFT run time reduction of six seconds per point over 18 minutes for three miles. Each pull-up is scored five

points with a maximum score of 100 and each sit-up is scored one point with a maximum score of 100 points.

In our analysis the PFT variable is taken to be the median of all PFT scores for each Marine conducted prior to the next rank. The individual scores consist of a 3-mile run, maximum pull-ups and maximum sit-ups in two minutes. Each Marine is required to conduct a scored PFT annually. Figure 2 shows histograms of PFT scores for male Marines by rank. Each histogram reflects a left-skewed distribution, likely a result of the maximum score cut off at 300 points.

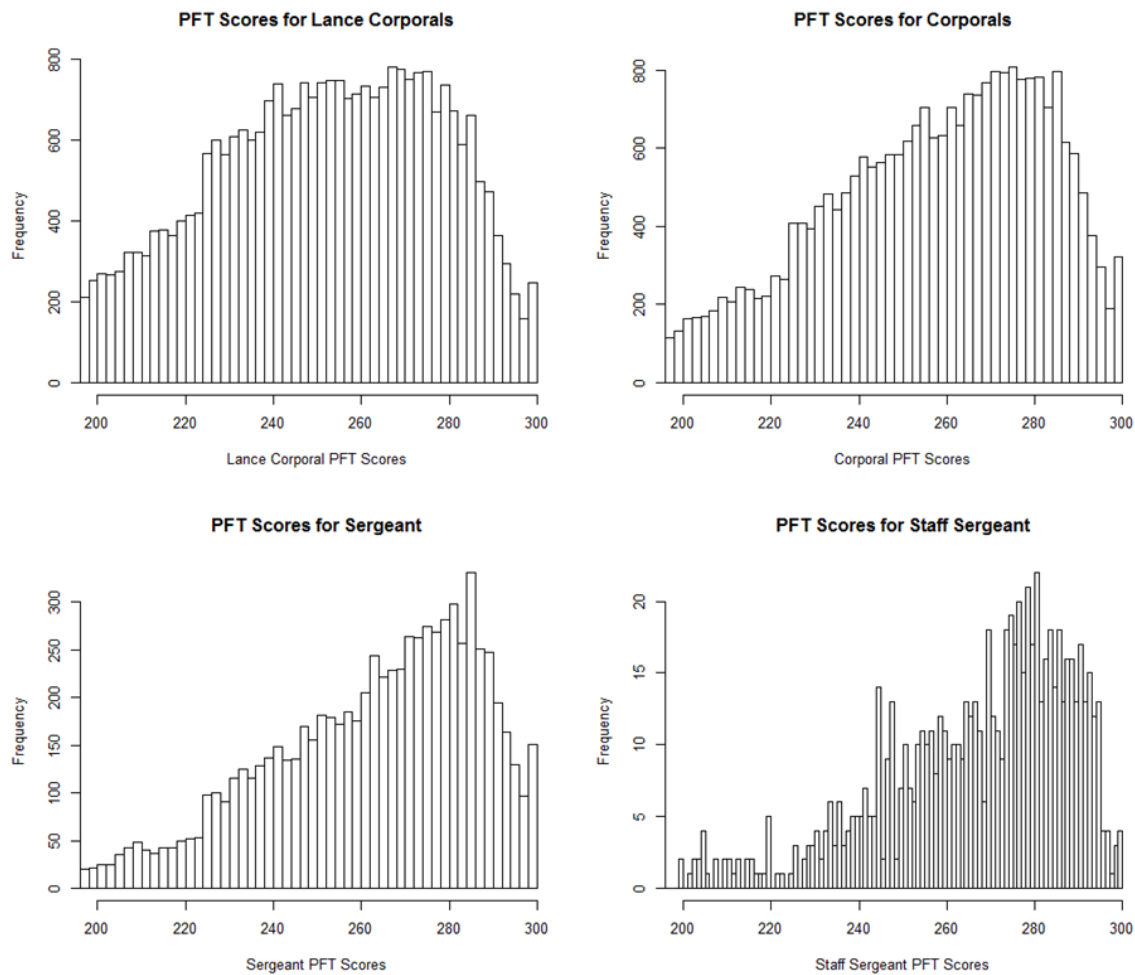


Figure 2. Histograms of Enlisted Infantry Marines' PFT Scores

The Combat Fitness Test variable is taken to be the median of all CFT scores conducted prior to promoting to the next rank. The purpose of the CFT is to assess overall ability to execute combat related tasks. It is “designed to evaluate strength, stamina, agility and coordination as well as overall anaerobic capacity” (USMC 2009). The test consists of three portions: maneuver under fire, movement to contact, and an ammo can lift. The maximum number of points for the CFT is 300. Each Marine is required to conduct a scored CFT annually. Because the CFT was implemented in July 2009 nearly half of the Marines in the data set (all entering from 2001 to 2009) do not have CFT scores prior to that date. Figure 3 shows four histograms of CFT scores by rank. The long left tail indicates that high CFT scores are frequent across every rank. This also indicates that the maximum score cut off at 300 points is masking the capabilities of those Marines with additional combat fitness capacity.

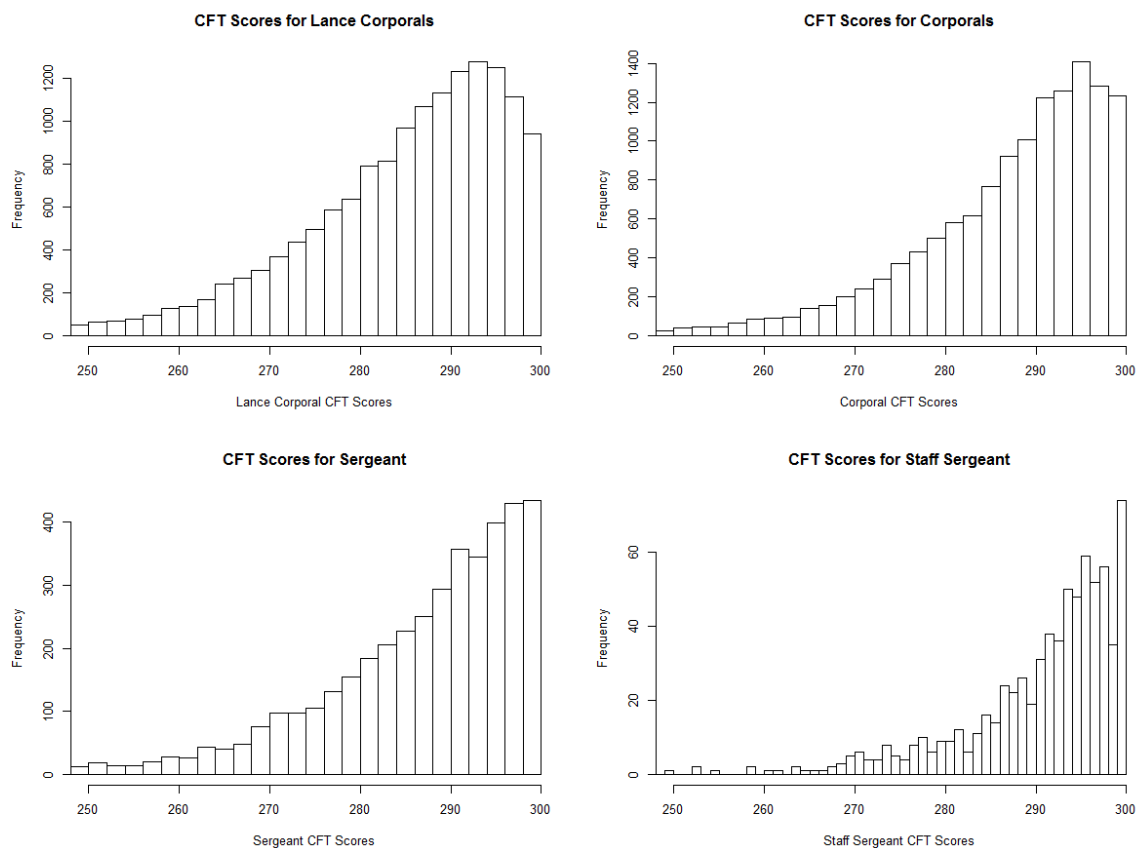


Figure 3. Histograms of Enlisted Infantry Marines' CFT Scores

The performance variables for the ranks of lance corporal and corporal consist of the median values of all proficiency marks and conduct marks that a Marine had received prior to the next promotion rank. As a lance corporal and corporal, each Marine receives a proficiency and conduct mark from their chain of command. Figure 4 shows the discrete nature of the proficiency and conduct marks. We also observe a shift in the averages to the right between the ranks of lance corporal and corporal. We further note that there is a visual similarity between the proficiency and conduct marks for each rank.

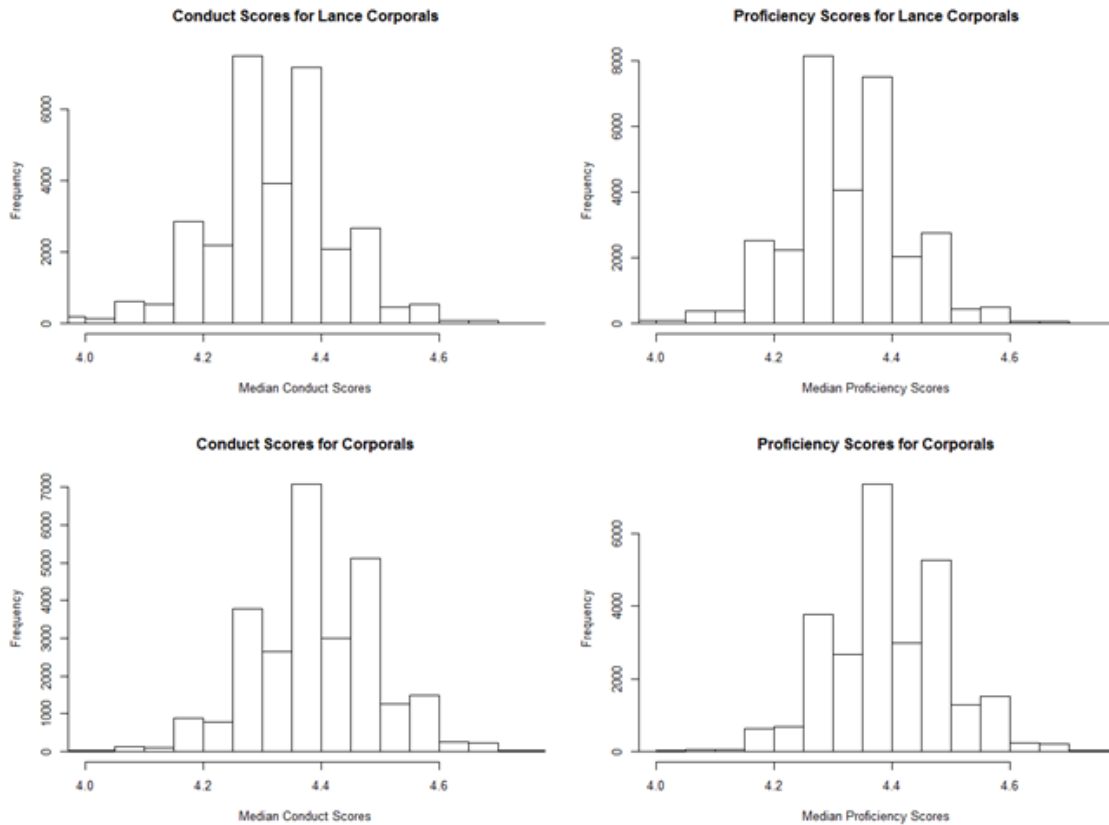


Figure 4. Histograms of Proficiency and Conduct Scores by Rank

At the sergeant and higher ranks a Marine receives a fitness report annually from their reporting senior (immediate commander) and no longer receives proficiency and conduct marks. The Median_RSRV variable is the median reporting senior relative value that we calculate for each Marine prior to their next promotion date or upon departure from the Marine Corps. Additionally, each Marine receives a performance evaluation

from their reviewing officer (RO) who is the reporting senior's immediate commander. The Median_ROCV variable is the median calculation of all reviewing officer cumulative values that we calculate for each Marine prior to their next promotion rank or upon departure from the Marine Corps. From the top portion of Figure 5 we observe relative normality (except in the tails) using Median_RSRV for the ranks of sergeant and staff sergeant. From the lower plots of the Median_ROCV we note long left tails, indicating the RO marking very low when low marks are provided. This would indicate a tendency for the reviewing officer to keep a tight profile centered on their average vice using the full scale allotted as used in the RSRV.

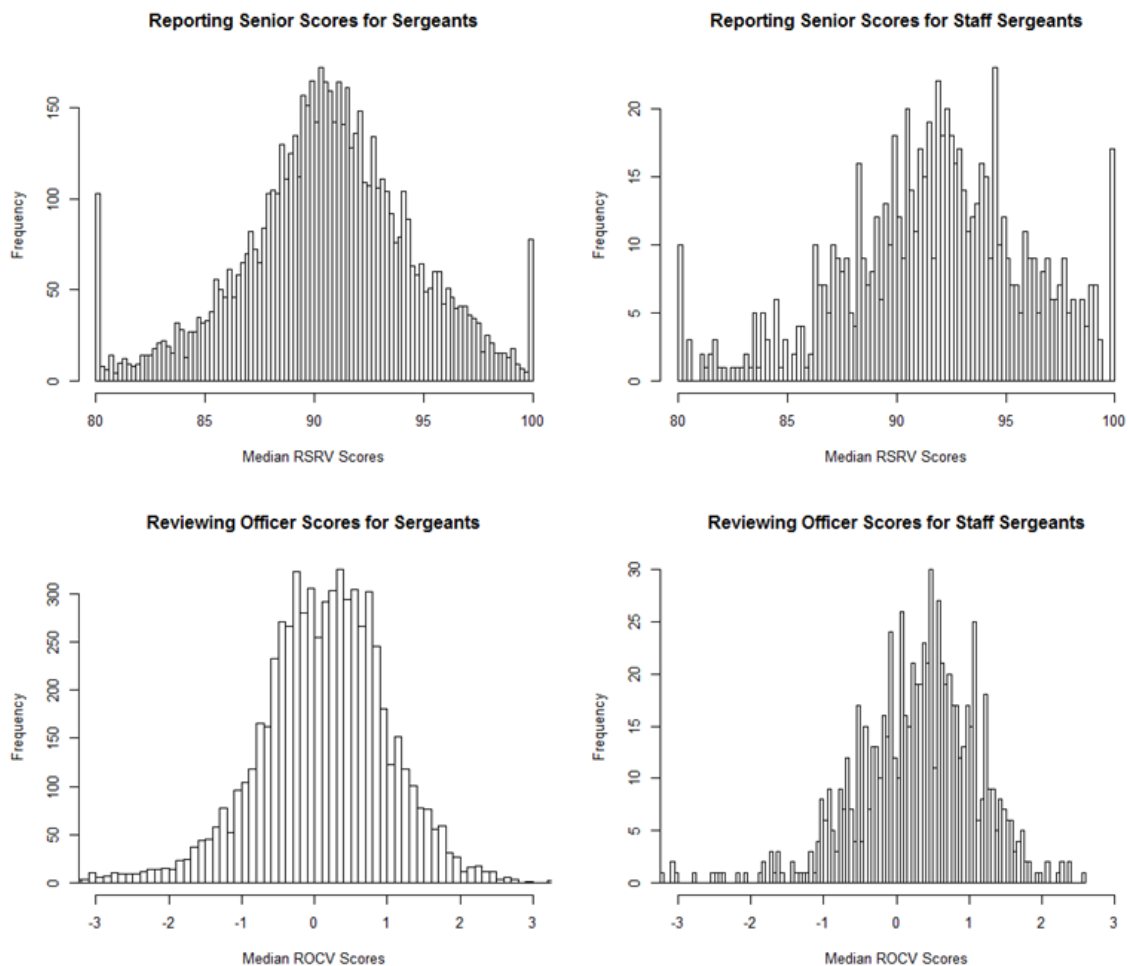


Figure 5. Histograms of Reporting Senior and Reviewing Officer Values

The GT_Total variable represents the individual general technical (GT) score each Marine received after taking the ASVAB test upon enlistment. This score does not change for a given Marine in any of our analyses. Although a Marine may elect to retake this portion of the ASVAB, the first score taken is used in our thesis research. From Figure 6 we observe that all ranks have a similar distribution of GT scores.

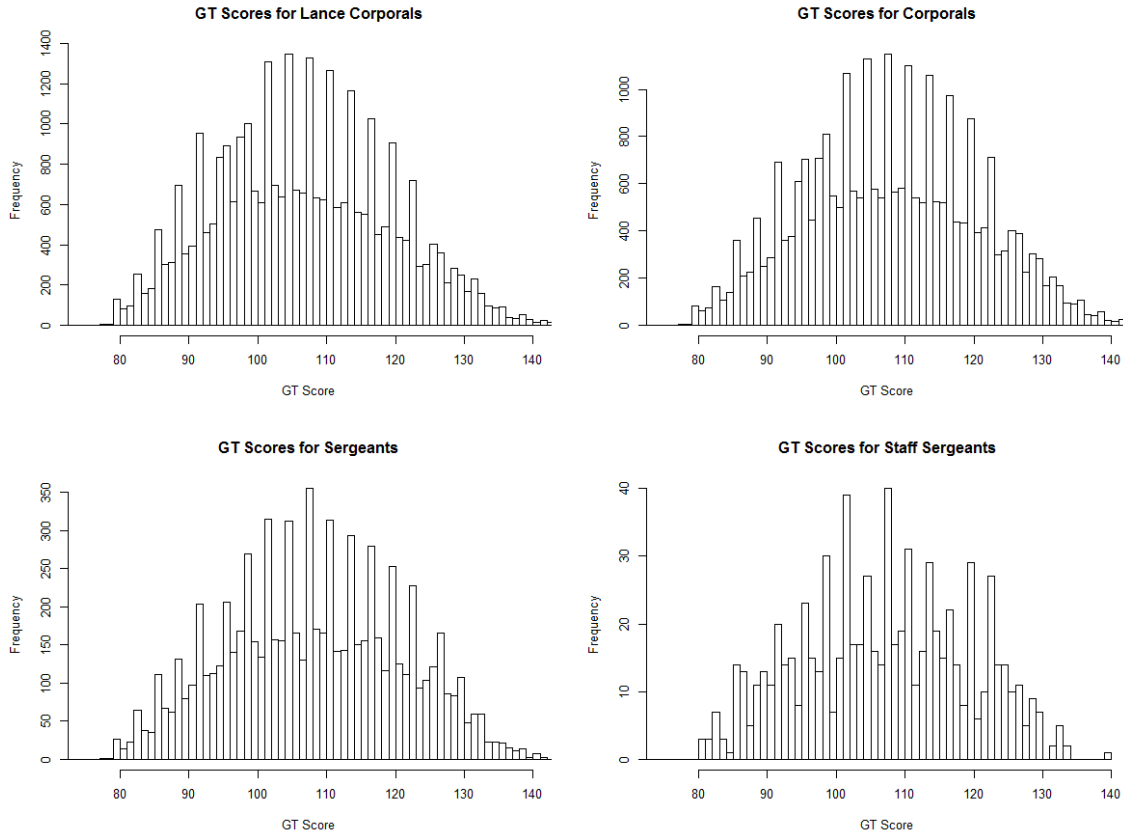


Figure 6. Histograms of General Technical Scores by Rank

The QUAL_SC variable represents an assessment for each Marine's rifle scores. To compress each Marine's multiple annual rifle scores into a single value, each score per year is assigned a value from zero to three corresponding to each of the following categories: "required did not take" is assigned a value of 0, a "marksman" level shooter is assigned a value of 1, a "sharpshooter" is assigned a value of 2 and an "expert" qualification is assigned a value of 3. Then the median of all annual rifle scores (prior to

the next rank) for each Marine is calculated and used as a Marine's rifle score. Figure 7 shows the rifle scores for all enlisted infantry Marines for this analyses. Higher rifle scores are seen as rank increases.

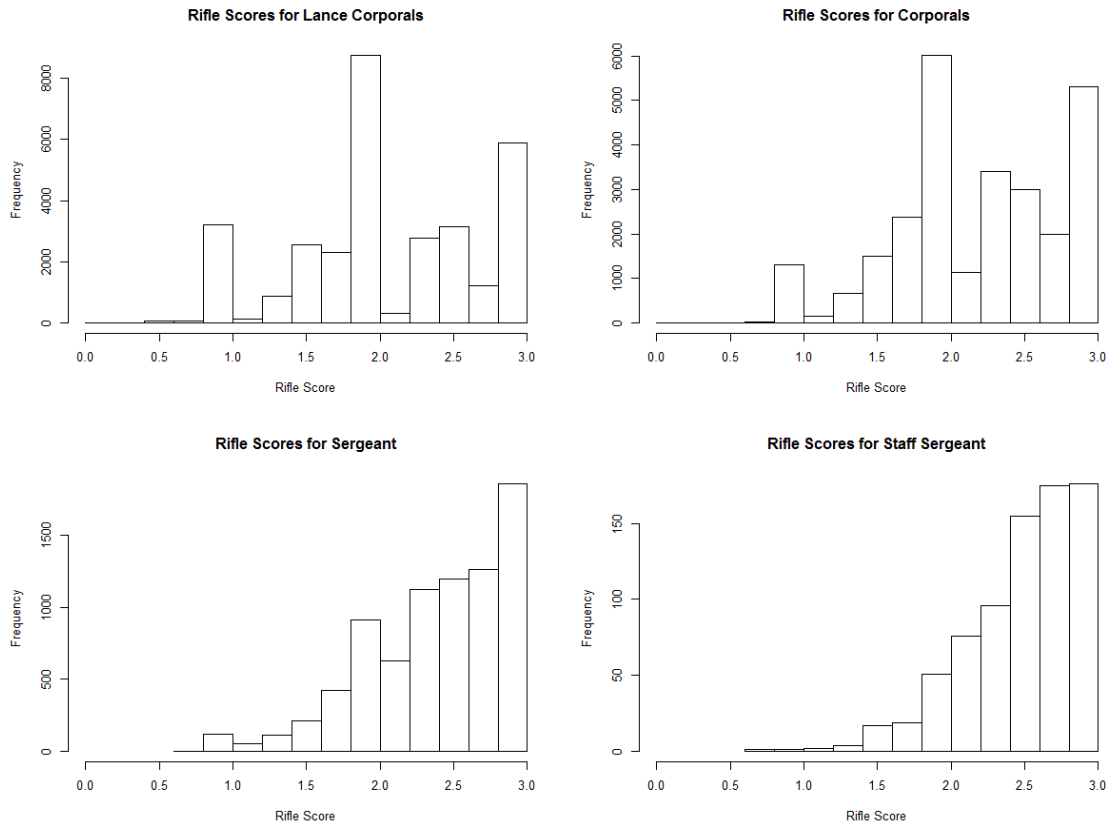


Figure 7. Histograms of Rifle Scores by Rank

The number of deployments is captured by the “RANK_DEP” variable which represents the total number of times each Marine deployed prior to promoting to the next rank or getting out of the Marine Corps. This variable does not distinguish between combat deployments and regular deployments. From Figure 8 it is clear that the longer a Marine serves the greater the number of deployments the Marine has completed. We also observe a high number of lance corporals, corporals, and sergeants have zero deployments which is not the situation for staff sergeants.

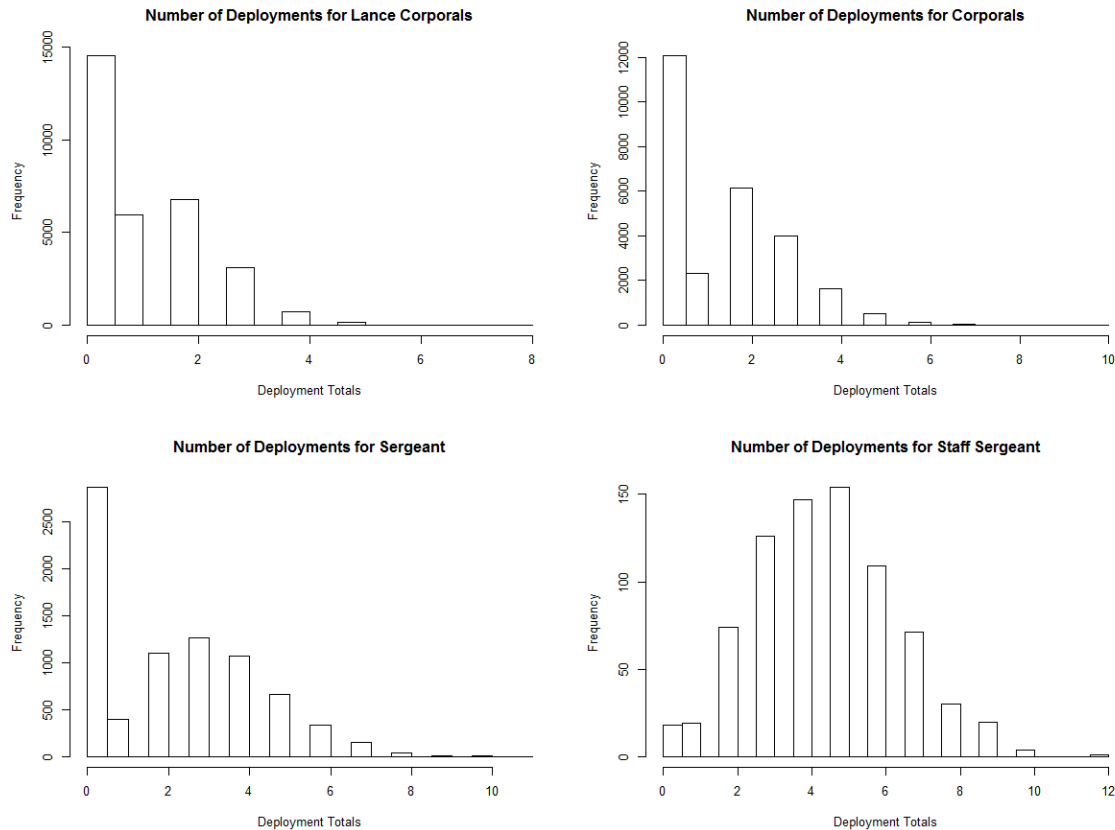


Figure 8. Histograms of Total Deployments by Rank

The waiver variables are consolidated from 11 categories into two count variables: negative waivers (Neg_Waivers) and neutral waivers (Neut_Waivers). Neg_Waivers includes those related to drugs, mental, law, hostile country of origin, education, medical and the number of dependents. Neut_Waivers includes those related to administrative reasons, age, and prior service. These variables are determined at the point of enlistment and remain constant throughout a Marine's career. From Figure 9 we observe that the presence of negative and neutral waivers received upon entry into the Marine Corps decreases as Marines promote to higher ranks.

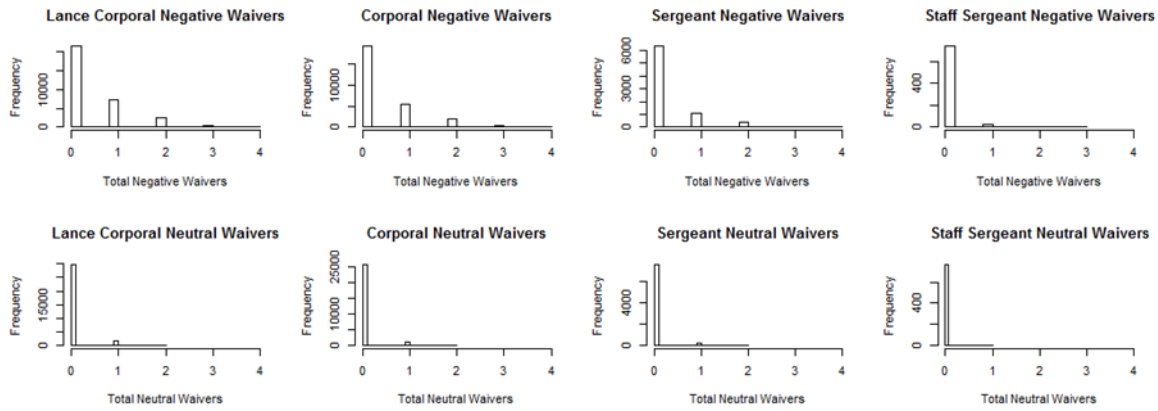


Figure 9. Histograms of Negative and Neutral Waivers by Rank

The weight control variable (WC) represents the number of times a Marine is officially entered into the weight control program. If a Marine has ever been on weight control that individual is given a value of one; otherwise, a value of zero. Entries were controlled across the rank subsets by including only weight control entries prior to promotion to the next rank date or departure date from the Marine Corps. From Table 8 we observe that the number of Marines on weight control decreases by half when comparing lance corporals to corporals.

Table 8. Weight Control for Lance Corporals and Corporals

Weight Control		
Number of Times on Weight Control	0	1
Lance Corporal (31312 Marines)	30553	759
Corporal (26840 Marines)	26514	326

For the ranks of sergeant and staff sergeant, who receive fitness reports which contain height and weight parameters, we calculate each male Marine's body mass index (BMI) with the following formula (Hartley 2017):

$$BodyMassIndex = Weight(pounds) / Height(inches)^2 * 703.$$

We then take the median of all BMI scores in rank to obtain an overall BMI score. From Figure 10 we observe that the BMI shifts slightly to the right indicating an increase in

body mass with age and rank. We also find the mean BMI for sergeant is 25.6 while staff sergeant is 25.9.

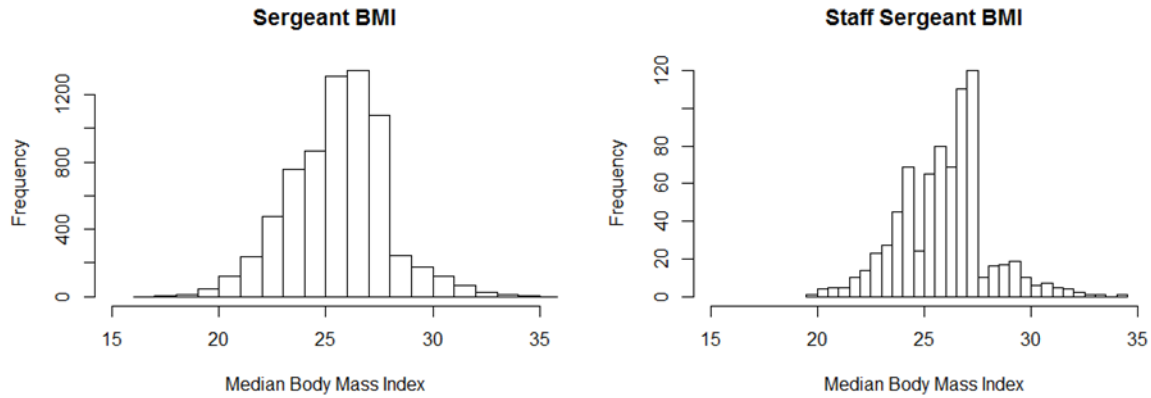


Figure 10. Histograms of Body Mass Index for Sergeants and Staff Sergeants

We now turn attention to the response variable which is a binary response on whether a Marine promotes beyond a given rank. We define this variable to isolate the question of who was retained and then promoted. From Table 9 we observe the response variable by rank, the total number of Marines further broken down by promoted and did not promote, and the associated percent of Marines that promoted. It is interesting that the staff sergeant sample shows a 51% promotion rate compared to a 29% promotion rate for sergeants. With the response variable computed we collect all factors that will be used for each analyses into Table 11. We note that there are 21 prediction variables available for our response variable and the classification model.

Table 9. Binary Response Variable for Promotion Beyond Current Rank

Binary Response Variable: Promotion by Rank			
Promoted Beyond	0: (Did Not Promote)	1: (Did Promote)	% Promote
Lance Corporal (31312 Marines)	9,692	21,620	69%
Corporal (26840 Marines)	16,622	10,218	38%
Sergeant (7893)	5,601	2,292	29%
Staff Sergeant (773)	382	391	51%

Table 10. Analyses Variables Used to Predict Promotion

Final Variables Used for the Analyses		
Original Attribute	Analysis Variables	Brief Description of Variables
ID	ID	Randomly generated identification number used to combine data from two systems
Prom_FR	Promote From	Response variable signifying whether a Marine promoted or executed EAS
PEBD	Pay Entry Base Date	Date a Marine began enlistment into USMC
RANK_PROFIC	Proficiency Value	Semi annual proficiency grade for Marines below rank of sergeant
RANK_CONDUCT	Conduct Value	Semi annual conduct grade for Marines below rank of sergeant
Median_RSRV	Reporting Senior Relative Value	Marine's fitness report value from their immediate supervisor
Median_ROCV	Reviewing Officer Cumulative Value	Marines fitness report value from their secondary supervisor
PFT_Median	Physical Fitness Test Scores	Annual physical test: 3 mile run, pull-ups, and sit-ups in two minutes
CFT_Median	Combat Fitness Test Score	Annual physical test: Manuever Under Fire, Movement to Contact, Ammo Can Lift
QUAL_SC	Rifle Qualification Score	Annual rifle qualification (Marksman, Sharpshooter, Expert, UNK)
P_Award	Personal Award	Acheivement, Commendation, Meritorious Service Medals
HP_Award	High Personal Award	Awards Bronze Star and above
PH	Purple Heart	Awarded for wounded or killed in action
V	Combat Distinguishing Device	Awarded for valorous action, accomondates other awards
CAR	Combat Action Ribbon	Awarded for executing ones duty in a combat environment
Neg_Waiver	Negative Waivers	Drugs, mental, law, hostile country origin, education, medical and # of dependents
Neut_Waiver	Neutral Waivers	Waivers required for each Marine upon entry into USMC
RANK_DEP	Deployment	The number of deployments a Marine has participated in
RANK_ADV	Adverse	The number of adverse fitness reports recieved
WC	Weight Control	Number of times a lance corporal and corporal are put on the weight control program
BMI	Body Mass Index	Weight normalization for sergeant and staff sergeant using height and weight
GT_scores	GT scores	General Technical score from the ASVAB

F. METHOD

We use Classification and Regression Trees (CART), as implemented by the **rpart** package from R (Therneau et al. 2015), to develop models to predict promotion based on attributes of a Marine. This method is adapted from Sam Buttrey's lecture titled "Advanced Data Analysis Part II: Trees" in August 2016 at the Naval Postgraduate School, Monterey California. It is used because of its resilience to outliers, ability to process missing values, resilience to monotonic transformation of variables, and ease of understanding.

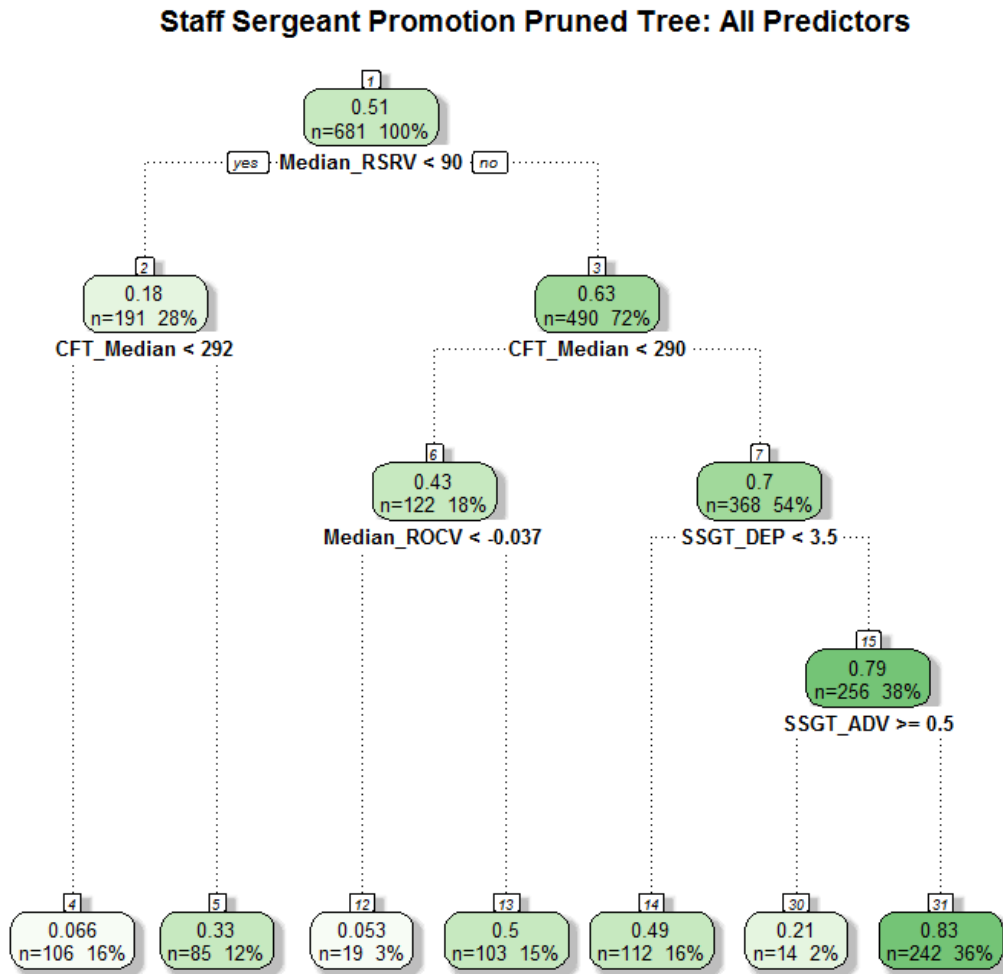
The objective of the CART modeling process is to predict the values of a response variable from a collection of predictor variables. We also aim to gain insight into the influence of the individual predictor variables. For a classification tree, the response variable has categorical values, and for a regression tree the response variable has continuous values (Rao 2013). CART uses a series of yes/no questions based on splits on a single predictor variable at a time to build up a decision tree structure. For the purposes of preventing overfitting and improving readability, the resulting trees typically are pruned using a local minimum cross validation error criterion (e.g., variance between groups).

We also seek to determine a measure of the quality of Marines that are promoted. First, we separate the Marines in a given rank into four performance groups of approximately equal size. For the ranks of lance corporal and corporal the performance groups are based on cut points using proficiency and conduct values. By taking the resulting number from each group and dividing by the total population size we get the proportion belonging to each group given that they were promoted. It is important to note that promoted is defined as Marines with a next rank promote date and rank listed in the TFDW data base. We do not investigate individual promotion board timelines, offers for reenlistment, or extenuating situations. Rather we gain general understanding from the effect of the promotion process by observing only the proportion of those Marines the Marine Corps retains, stay in the Marine Corps and actually promote. These proportions are further broken down by year to analyze the effects of upsizing and downsizing the Marine Corps over the years studied.

1. Interpreting the Tree Diagram

We illustrate the interpretation of a CART prediction tree diagram using Figure 11, which is obtained by applying functions from the **RColorBrewer** (Neuwirth 2014) and **Rattle** (Williams 2011) packages in R to the CART output. Observe that each split in the tree states the proportion of Marines that promote, and the number and percentage of Marines in each node determined by the splitting variable. Beginning at the top of the tree, approximately half (.50) of the total sample of 681 staff sergeants (100% of sample) promote. The first split uses the median reporting senior relative values (Median_RSRV) which divides the sample into two groups: those that are less than 90 (branching left) and those that are greater than or equal to 90 (branching right). For the 191 Marines in the “yes” branch, which comprises 28% of all staff sergeants in the analysis, approximately 18% promote to gunnery sergeant. Following the right branch from Median_RSRV we note: combat fitness scores (CFT_Median) above 290, number of deployments for a staff sergeant (SSGT_DEP) or greater than 3.5 (four deployment or more) and adverse report (SSGT_ADV) less than .5 (a Marine has never received an adverse fitness report) all give the staff sergeant rank the highest probability for

promoting (83%). This classification applies to 242 (36%) of staff sergeants promoted in the classification tree.



The proportions of promotion in each node are the numbers on the first line in each box. The numbers and percentages of observations in each node are shown on the second line in each box.

Figure 11. Example Classification and Regression Tree

2. Classification Rate

The next step is to evaluate the prediction success of the model using a confusion matrix. For this analysis we randomly select approximately 10% of Marines from the data and set them aside as a test set. We fit a CART model using the remaining 90% of the data and measure how well it classifies the test set. The **predict** function applied to the

output of this model is a vector of estimated probabilities of promotion for all observations in the data set. A Marine is classified as promoted if the estimated probability is greater than or equal to a preset threshold, and is classified as not promoted otherwise. The classification accuracy of a threshold is given by two proportions: of those who do promote, the proportion that are predicted to promote; and of those who do not promote, the proportion that are predicted to not promote. We take the minimum of these two proportions as a measure of the accuracy of the classification rule using a particular threshold, and we seek to maximize this measure through the choice of a threshold. We consider threshold values in the range of zero to one in increments of .01 for this optimization.

3. Method Overview

After we create and interpret the classification tree for each rank we remove the performance variables and create another classification tree. We then compare the two trees (with performance and without performance variables) and the classification rates for both trees. Based off the classification rate comparisons we assess which model correctly classifies a higher proportion of Marines as either promote or not and we do this for each by rank. We then assess the value gained through the inclusion of performance evaluation.

IV. RESULTS

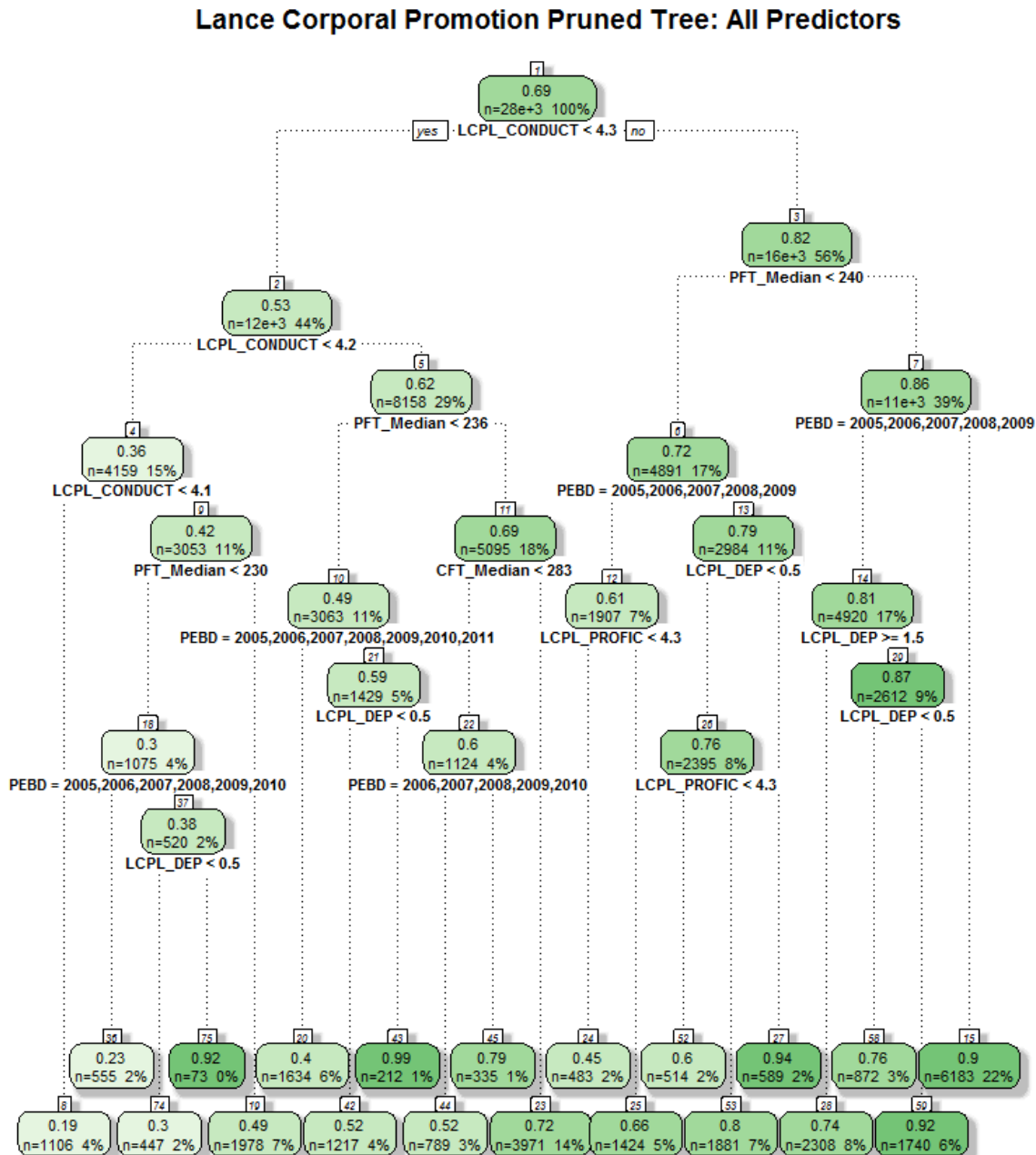
The purpose of this thesis is to analyze the effects that the prediction variables have on Marines that are retained by the Marine Corps, continue to serve and actually promote. We use classification and regression trees to visually show the effect that certain factors have toward those that promote and do not promote. This chapter summarizes the result from the analyses, and it describes how much the performance evaluation process contributes to predicting promotion. Each analysis is interpreted initially by rank and the evaluation system used and then by comparison across all ranks. We conclude with a summary analysis from all four ranks.

A. LANCE CORPORALS (WITH PEBD 2001 TO 2011)

1. Classification and Regression Tree Prediction with All Variables

Using 90% of the lance corporal data as a training set we construct the classification and regression tree presented in Figure 12 which reflects either being promoted and retained or not. From this tree we note a 69% promotion rate for the rank of lance corporal to corporal for Marines with PEBD years from 2001 to 2011. Starting at the top of the tree, observe that the first split occurs at LCPL_CONDUCT: values less than 4.3 break to the left and values greater than or equal to 4.3 break to the right. Those with conduct scores less than 4.3 have an overall promotion rate of 53% and those with conduct scores at or above 4.3 have an overall promotion rate of 81%. We find that for an infantry lance corporal to have the greatest chance of promotion he would need a PFT_Median score greater than 240, proficiency and conduct median scores above 4.3, CFT_Median scores above 284, PEBD from 2005 to 2009 and to have had at least one deployment. Figure 12 also shows that Marines with conduct marks below 4.2 and a high PFT or CFT score still have greater than a 24% probability of promoting while a PFT score split above 236 accounts for half the lance corporal sample. To have the greatest probability for promotion a lance corporal needs to have a conduct score average above 4.3, a median PFT score above 240, and accessed during a period of force increase (e.g.

2005 to 2009). The lowest probability on the tree is 24% indicating a one if four chance of promoting for the worst performers.



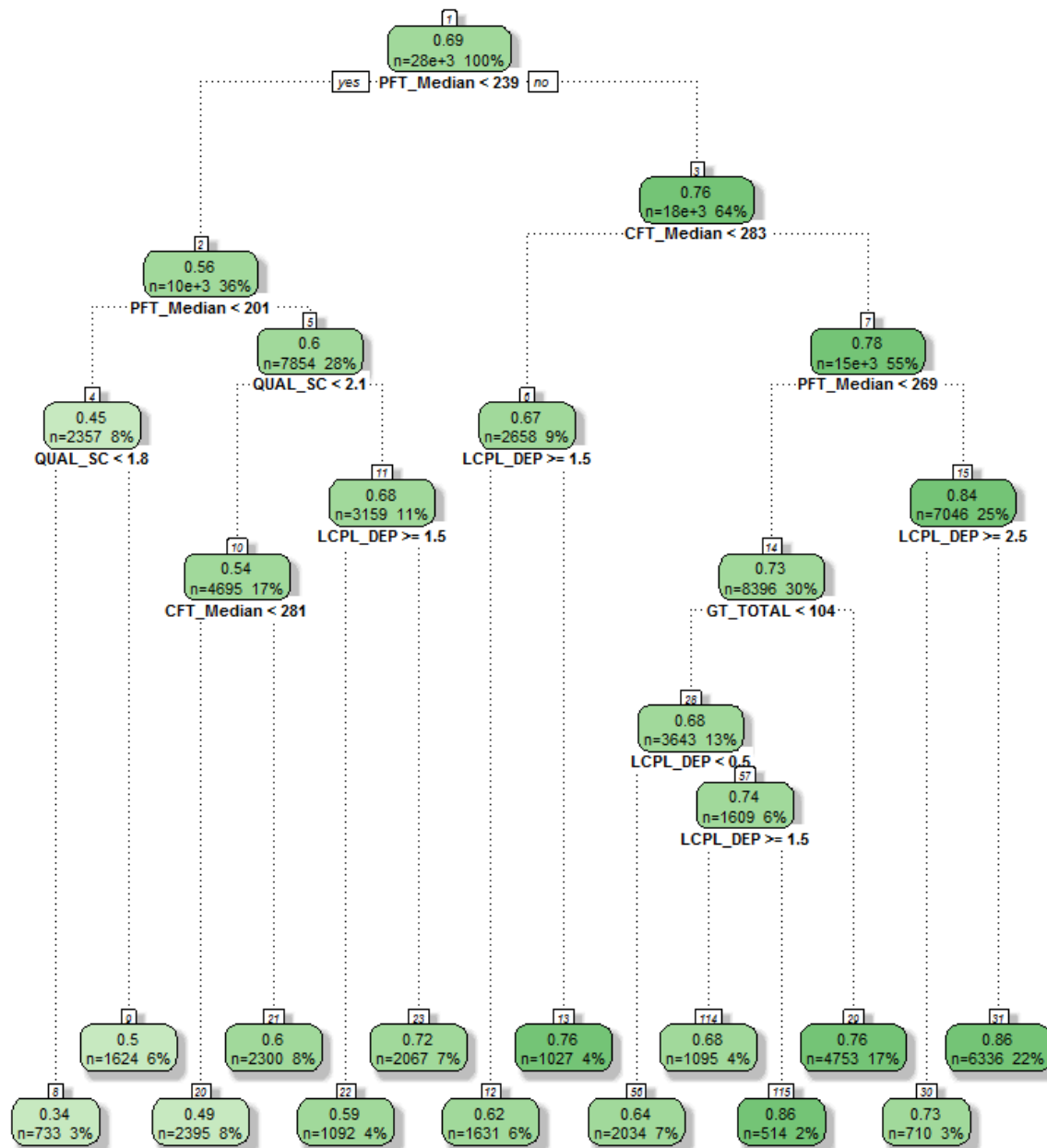
Pruned tree for prediction of promotion for the rank of lance corporal with all predictor values included indicating important predictor splits. Tree branches occur at conduct (LCPL_CONDUCT), PFT scores (PFT_Median), and PEBD.

Figure 12. Classification and Regression Tree with All Predictors Included for Promotion from Lance Corporal to Corporal (2001 to 2011)

2. Classification and Regression Tree without Performance Variables

To explore how performance evaluation influences the promotion process we remove those variables (LCPL_PROFIC and LCPL_CONDUCT) and reproduce the tree diagram as in Figure 13. We observe that the first split in the tree is the PFT_Median score of less than 240 with a probability of promotion of 56% and greater than 240 with a probability of promotion of 76%. For the greatest probability of promotion, a Marine must then deploy at least once and have a high GT score. For those Marine with low PFT scores, the Rifle Score become important between 2.1 and 2.2 indicating Marksman with at least one Expert qualification, recall (Sharpshooter =1, Marksman = 2 and Expert = 3). Finally, we observe a split at the GT_Score of 108 after the number of deployments.

Lance Corporal Promotion Pruned Tree: Without Proficiency or Conduct



Pruned tree for prediction of promotion for the rank of lance corporal with proficiency and conduct predictor values removed indicating important predictor splits. Tree branches occur at PFT scores (PFT_Median), CFT scores (CFT_Median), the number of deployments (LCPL_DEP), and rifle qualification score (QUAL_SC).

Figure 13. Classification and Regression Tree with Proficiency and Conduct Scores Removed as Predictors for Promotion from Lance Corporal to Corporal (2001 to 2011)

Next we determine the effectiveness of the two different classification trees to assess the importance of including performance variables. The classification trees are produced using 90% of the lance corporal data with 10% held in reserve to determine how well the model accurately predicts promotion. Using the estimated probabilities, a threshold for classification into promoted and not-promoted groups is determined to maximize the smaller of the two correct classification rates (for those that promote and for those that do not promote). We then calculate estimated correct classification probabilities using data from the test set. From Table 11 we observe that the estimated correct classification probabilities are 66% for Marines that promote and 64% for Marines that do not promote. After we remove the performance we find that the model accurately classifies Marines that promote with a probability of 70% and Marines that did not promote with a probability of 50%. We then compare the two model classification rates and note that the exclusion of proficiency and conduct marks reduces the correct classification rate of those who do not promote to a substantial degree.

Table 11. Test Set Estimated Correct Classification for Lance Corporal Retention and Promotion

Lance Corporal (E-3): Proficiency and Conduct System				
	All Predictors		Proficiency/Conduct Removed	
	Promote	Not Promote	Promote	Not Promote
Optimal Threshold Value	> .7	≤ .7	> .68	≤ .68
Estimated Correct Prediction Probability	0.66	0.64	0.70	0.50

3. Proportion of Lance Corporals Promoted by Performance Quadrant

Are the highest performing Lance Corporals advancing to the next rank? To answer this question, we first take the sample of lance corporals and split them by their performance scores (proficiency and conduct) into four categories (quadrants) of approximately equal size and determine the proportion of Marines that promote from each of the four quadrants. Recall that we only consider Marines that remain in the Marine Corps long enough to promote to the next rank.

We next observe what proportion of lance corporals are promoted by quadrant for the years 2001 to 2011. From Table 12 we observe the average proficiency quadrant

promotion rates across all years. The proportion of Marines promoted from the LOW performer quadrant is 12%, MID-LOW 38%, MID-HIGH 27%, and 23% of Marines promoted come from the HIGH performers. We note the quadrant splits for low performing Marines have median proficiency and conduct scores between 0 and 4.29 and account for 11% to 17% of lance corporals. The next quadrant (MID-LOW) performers have proficiency and conduct values from 4.29 to 4.35 and represent 28% to 43% of lance corporals. MID-HIGH performing Marines are those with median proficiency and conduct scores between 4.35 and 4.40 and consist of 24% to 30% of lance corporals. The top (HIGH) performing Marines have scores from 4.4 to 5.0 and account for 17% to 28% of the population. We note that the marginal separation between the top three quadrants spans 4.29 to 5.0.

Table 12. Proportion of Lance Corporals Promoted Annually by Quadrant

Lance Corporal Conduct Range P(Quadrant Prom) by Year													
Quadrant	Conduct Range	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
LOW	0.00 to 4.29	0.13	0.11	0.12	0.14	0.12	0.12	0.14	0.14	0.16	0.17	0.17	14%
MID-LOW	4.29 to 4.35	0.32	0.28	0.34	0.36	0.39	0.35	0.36	0.41	0.43	0.39	0.36	36%
MID-HIGH	4.35 to 4.40	0.28	0.27	0.26	0.26	0.25	0.28	0.29	0.25	0.24	0.27	0.26	27%
HIGH	4.40 to 5.00	0.27	0.34	0.28	0.24	0.24	0.25	0.20	0.20	0.17	0.17	0.20	23%
Lance Corporal Proficiency Range P(Quadrant Prom) by Year													
Quadrant	Proficiency Range	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
LOW	0.00 to 4.29	0.10	0.08	0.10	0.11	0.12	0.10	0.12	0.13	0.17	0.15	0.15	12%
MID-LOW	4.29 to 4.35	0.33	0.30	0.36	0.38	0.39	0.39	0.31	0.41	0.44	0.43	0.41	38%
MID-HIGH	4.35 to 4.40	0.30	0.28	0.26	0.26	0.27	0.27	0.27	0.26	0.24	0.25	0.25	27%
HIGH	4.40 to 5.00	0.26	0.33	0.27	0.25	0.22	0.24	0.20	0.19	0.15	0.17	0.19	23%

For the Marine Corps to promote and retain as many high quality Marines as possible we expect to see the greatest proportion from the HIGH performers and less from each subsequent quadrant. We would expect to see 50%, 30%, 18%, and 2% as a reasonable estimate for the proportion of Marines promoted HIGH performance quadrants and down. But it appears that performance evaluation include is viewed as coming from the top three quadrants with policy restricting only the lowest performing Marines.

To better visualize the proportion of lance corporals promoted by performance quadrant and year we plot the data. From Figure 14 we see that there are trends over time for each quadrant. The LOW performance quadrants have an increasing trend over time while the HIGH performing quadrants have a decreasing trend over time. Instead of observing a reasonable estimate (50, 30, 18, 2 breakdown), we observe of a 20, 25, 35, 10 breakdown which trends to a 17, 25, 43, 15 breakdown of high to low performance retention and promotion model. These results indicate a model that is losing a large proportion of its top performing and above average Marines.

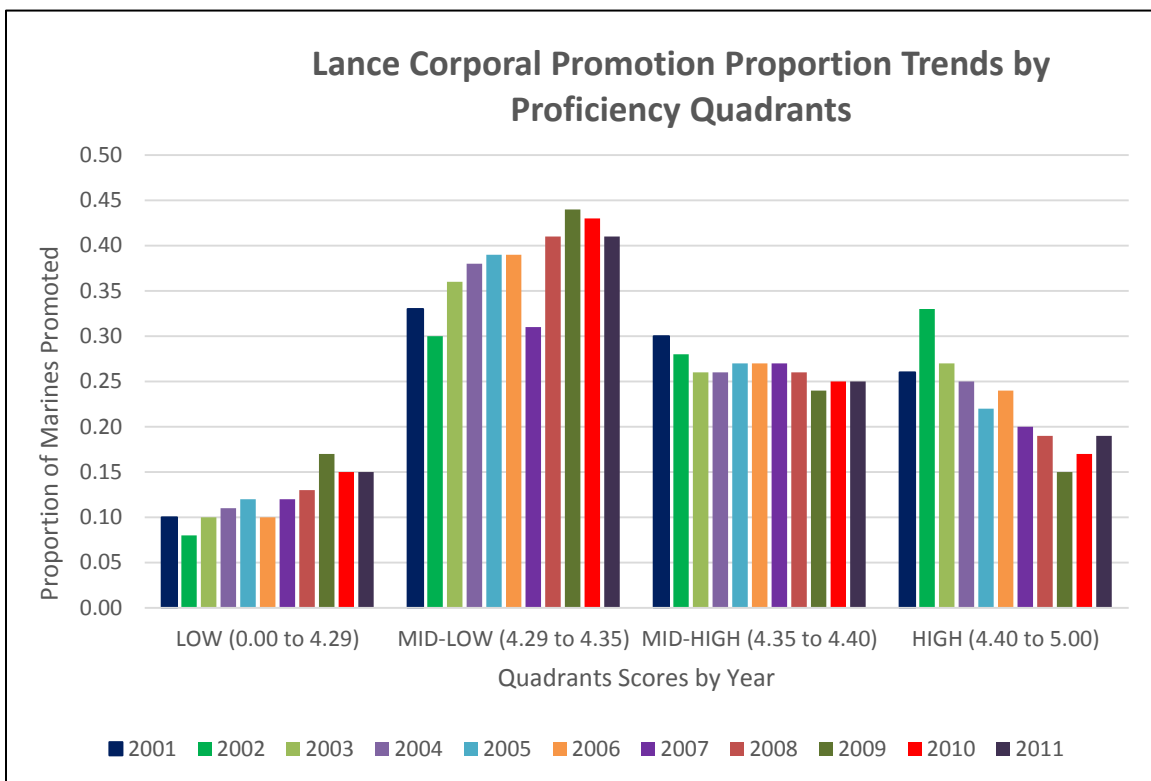


Figure 14. Lance Corporal Promotion Proportion by Proficiency Quadrant

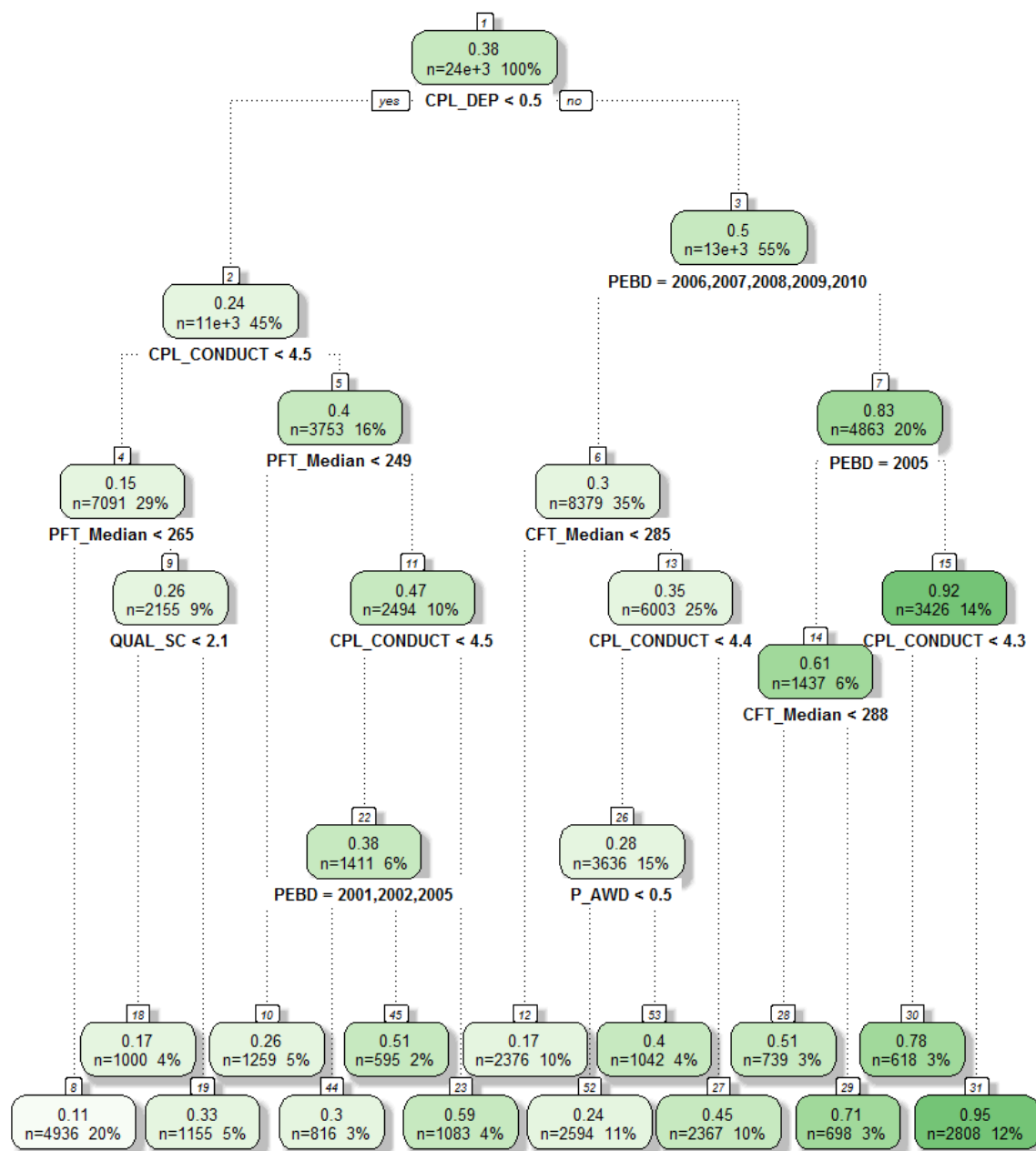
B. CORPORAL (WITH PEBD 2001 TO 2010)

1. Classification and Regression Tree Prediction with All Variables

For the corporal rank we estimate the probability of being promoted to be 19,601 divided by 28,312 or 38% during the time frame of our study. From the top of the tree in Figure 15 we see that the number of CPL_DEP (deployments) is the most important predictor of promotion. Corporals with no deployments encompass roughly 45% of this group and have a 24% estimated probability of promotion. The best chance that a corporal with no deployments can achieve is 60% and requires a CPL_CONDUCT score above 4.5 and a PFT_Median score above 249. Those corporals with at least one deployment (55% of corporals) split to the right and have a probability of promoting of 50% but can increase their chances of promotion up to 94% by having entered the Marine Corps in 2005 and having a CPL_CONDUCT score greater than 4.3. Those with at least one deployment, PEBD of 2001 to 2004 and a CFT above 288 have a 71% estimated probability of promoting.

From observation we generalize that PFT scores above 249, CFT_Median scores above 280, P_AWD (achievement or commendation medal) of at least one, with a median QUAL_SC (rifle score) above the marksman level increase a Marine's overall probability of promotion. For the lance corporal rank LCPL_CONDUCT is at the top of the tree while for corporals the CPL_DEP (number of deployments) is the first split.

Corporal Promotion Pruned Tree: All Predictors



Pruned tree for prediction of promotion for the rank of corporal with all predictor values included indicating important predictor splits. Tree branches occur at the number of deployments (CPL_DEP), PEBD, conduct values (CPL_CONDUCT), PFT scores (PFT_Median), rifle qualification score (QUAL_SC), and the number of personal awards (P_AWD).

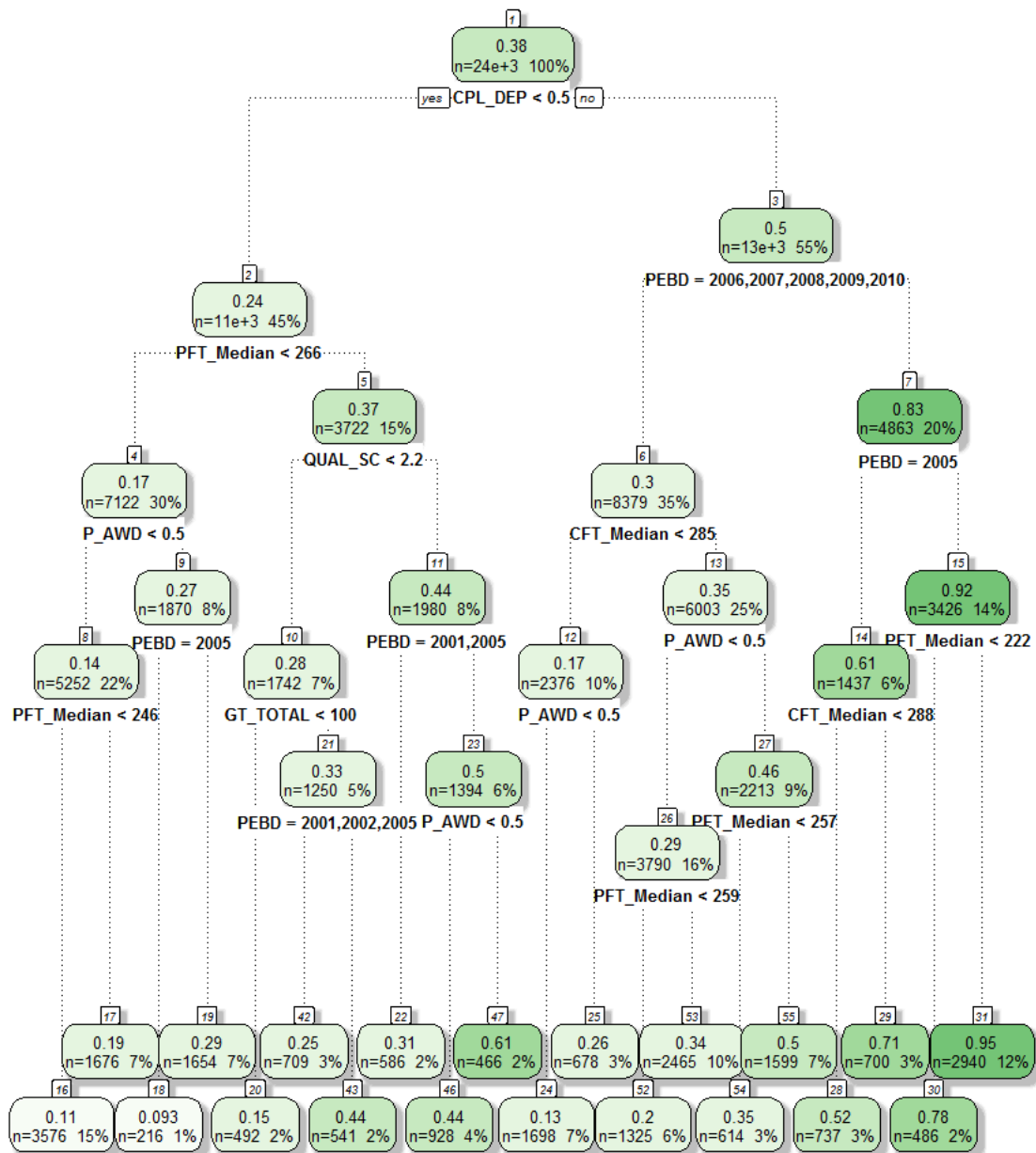
Figure 15. Classification and Regression Tree with All Predictors Included for Promotion from Corporal to Sergeant (2001 to 2010)

2. Classification and Regression Tree without Performance Variables

From Figure 16 we observe that after removing the performance related prediction variables (CPL_PROFIC and CPL_CONDUCT) that CPL_DEP (deployments) remain the initial split. Those without a deployment have a 24% chance of promoting which increases if their PFT_Median is greater than 266, have a QUAL_SC (rifle scores) above 2.2, a PEBD of 2001 or 2005, and at least one P_AWD can get their probability of promotion up to 61%. When we observe the effect of having an award for the rank of corporal, we note a 13–16% probabilistic difference for Marines promoting. A high CFT and PFT score improves the probability of promotion in almost all cases. Finally, as observed with the lance corporal rank the GT score split at 108 indicates some necessity for general technical skill at that level. For those Marines with at least one deployment we observe that the greatest probability, 95%, comes from a PEBD of 2005 and a PFT_Median score above 222.

With PEBD appearing frequently in the classification tree, it is clear that policies of the Marine Corps taken over time should be taken into account for predicting promotion. What those policies would be in the future cannot be foreseen which suggest that the model should be re-estimated periodically over time.

Corporal Promotion Pruned Tree: Without Proficiency or Conduct



Pruned tree for prediction of promotion for the rank of corporal tree with proficiency and conduct predictor values removed indicating important predictor splits. Tree branches occur at the number of deployments (CPL_DEP), PEBD, PFT scores (PFT_Median), CFT scores (CFT_Median), rifle qualification score (QUAL_SC), and the number of personal awards (P_AWD).

Figure 16. Classification and Regression Tree with Proficiency and Conduct Scores Removed as Predictors for Promotion from Corporal to Sergeant (2001 to 2010)

We next compare the prediction skill of the two classification trees using the test set for corporals. We use the **predict** command in R to estimate the probabilities of being promoted from the training set using a classification tree. Using the estimated probabilities and threshold for classification as in Table 13 we calculate the estimated correct classification probabilities using the test set. For the full model (with performance variables) we estimate a 60% correct classification probability for those that promote and a 79% correct classification probability for those that do not promote. For the model without performance variables we estimate a correct classification rate of 59% for those that promote and a 77% correct classification rate for those that do not promote. From this we note that the inclusion of proficiency and conduct improves variable classification accuracy but only slightly.

Table 13. Test Set Estimated Correct Classification for Corporal Retention and Promotion

Corporal (E-4): Proficiency and Conduct System				
	All Predictors		Proficiency/Conduct Removed	
	Promote	Not Promote	Promote	Not Promote
Optimal Threshold Value	>.34	≤.34	> .31	≤.31
Estimated Correct Prediction Probability	0.60	0.79	0.59	0.77

3. Proportion of Corporals Promoted by Performance Quadrant

Next we ask what proportion of high performing corporals promote and advance to the next rank? From Table 14 we note that the estimated probabilities are similar to those for the lance corporals. For HIGH performance we notice a decrease in the proportion of corporals promoted while the LOW performer quadrant appears to be steadily increasing with time. This indicates that during the years the Marine Corps needed more Marines the proficiency and conduct marks had less value toward promotion. We make a mental note that corporals promoting to sergeant have roughly a 20, 35, 35, 10 proportional breakdown from high to low performance. We observe that over time there is a slight trend effect so we plot the data for corporals to pronounce the effect.

Table 14. Proportion of Corporals Promoted Annually by Quadrant

Corporal Conduct Range P(Quadrant Prom) by Year												
Quadrant	Conduct Range	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
LOW	0.00 to 4.29	0.12	0.09	0.11	0.13	0.15	0.14	0.14	0.18	0.13	0.07	13%
MID-LOW	4.29 to 4.35	0.27	0.24	0.31	0.33	0.36	0.35	0.39	0.38	0.38	0.34	34%
MID-HIGH	4.35 to 4.40	0.36	0.37	0.37	0.37	0.36	0.34	0.37	0.31	0.35	0.34	35%
HIGH	4.40 to 5.00	0.26	0.30	0.21	0.16	0.13	0.17	0.10	0.13	0.14	0.25	19%

Corporal Proficiency Range P(Quadrant Prom) by Year												
Quadrant	Proficiency Range	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
LOW	0.00 to 4.29	0.10	0.08	0.09	0.12	0.14	0.12	0.12	0.17	0.13	0.03	11%
MID-LOW	4.29 to 4.35	0.25	0.26	0.31	0.34	0.39	0.36	0.40	0.38	0.37	0.32	34%
MID-HIGH	4.35 to 4.40	0.30	0.38	0.39	0.38	0.33	0.36	0.36	0.32	0.36	0.40	36%
HIGH	4.40 to 5.00	0.25	0.28	0.21	0.16	0.14	0.16	0.12	0.13	0.14	0.25	18%

From Figure 17 we note the data appears to be proportional large in the middle two quadrants. The notable drop in proportion of Marines promoted from the bottom quadrant in 2010 indicates a significant push toward retaining and promoting top performing Marines. This (25, 40, 32, 3) breakdown while a better then and previous rank, does not achieve the reasonable estimate (50, 30, 18, 2) high to low performance breakdown.

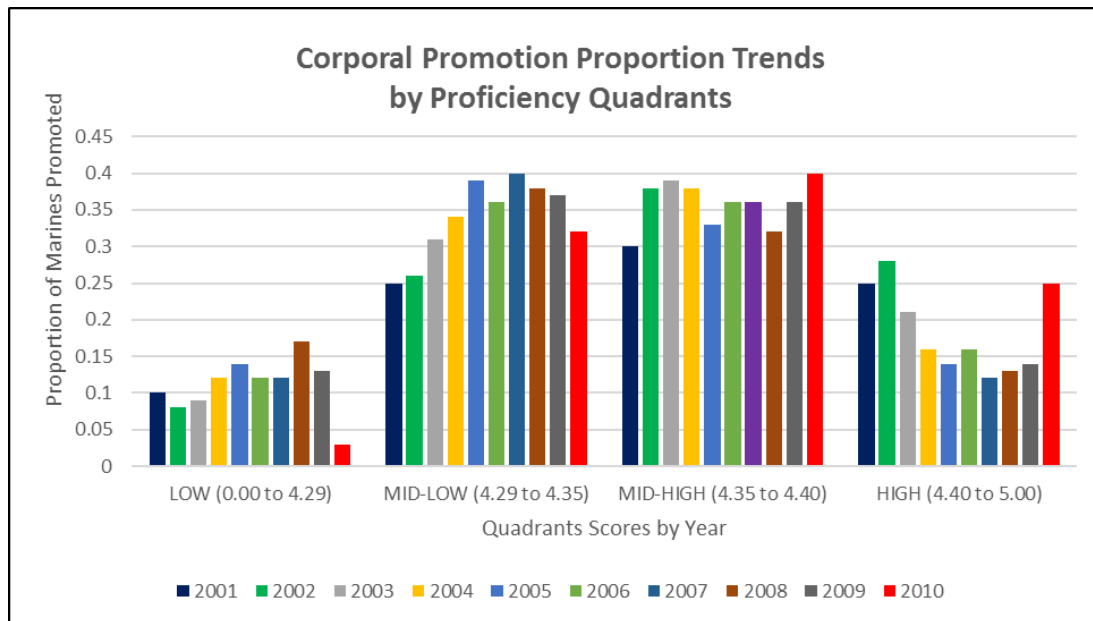


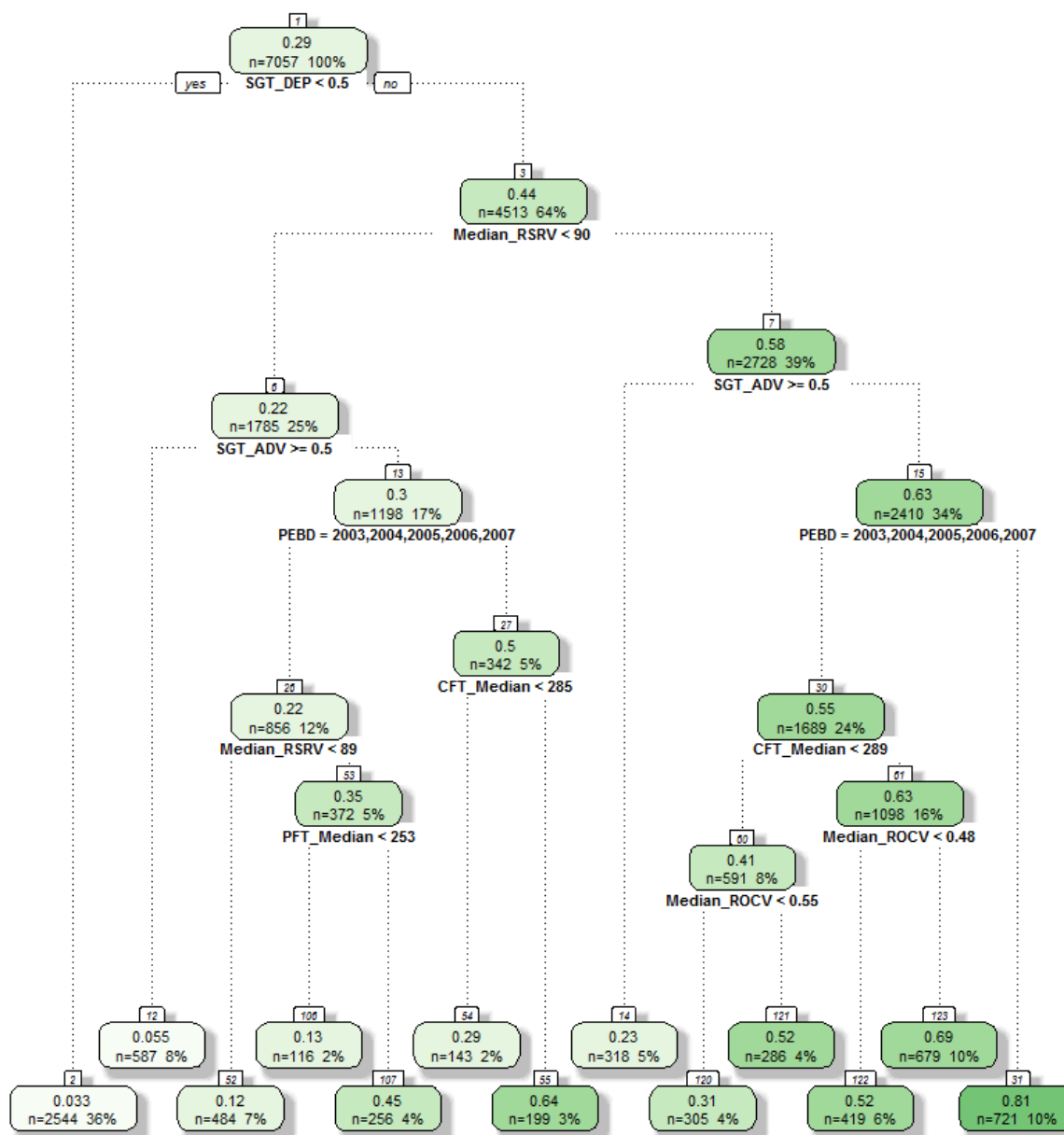
Figure 17. Corporal Promotion Proportion Proficiency Trends by Quadrant and Year

C. SERGEANT (WITH PEBD 2001 TO 2007)

1. Classification and Regression Tree Prediction with All Variables

We now observe the impact of fitness reports on enlisted infantry promotions for the rank of sergeant. From the CART we see that from the 7,057 sergeants observed that 2,059 promote, which is roughly 29% of the total. From Figure 18 we observe the first split for sergeants at SGT_DEP (number of deployments) corresponding to a zero and one or more. From the 36% of sergeants that did not deploy only 3% promoted. For those that did deploy their Median_RSRV (reporting senior) values split at 90%, indicating above or below average Marines. Those with above-average Median_RSRVs are able to increase their probability of promoting to 58% while those below average scores decrease to 22%. We note that 5% of all Sergeants are both ranked above average by their reporting senior and get adverse fitness reports and 8% of all sergeants get both below average marks and receive at least one adverse fitness report. We also note that CFT_Median scores above 285 will increase probabilities of promotion. PEBD has an important effect throughout especially on those that entered service from 2001 to 2002, (81% of whom promoted). The greatest probability of promotion combination comes from a sergeant with at least one deployment, median_ RSRV above 90, no adverse fitness reports, and PEBD between 2001 to 2002.

Sergeant Promotion Pruned Tree: All Predictors



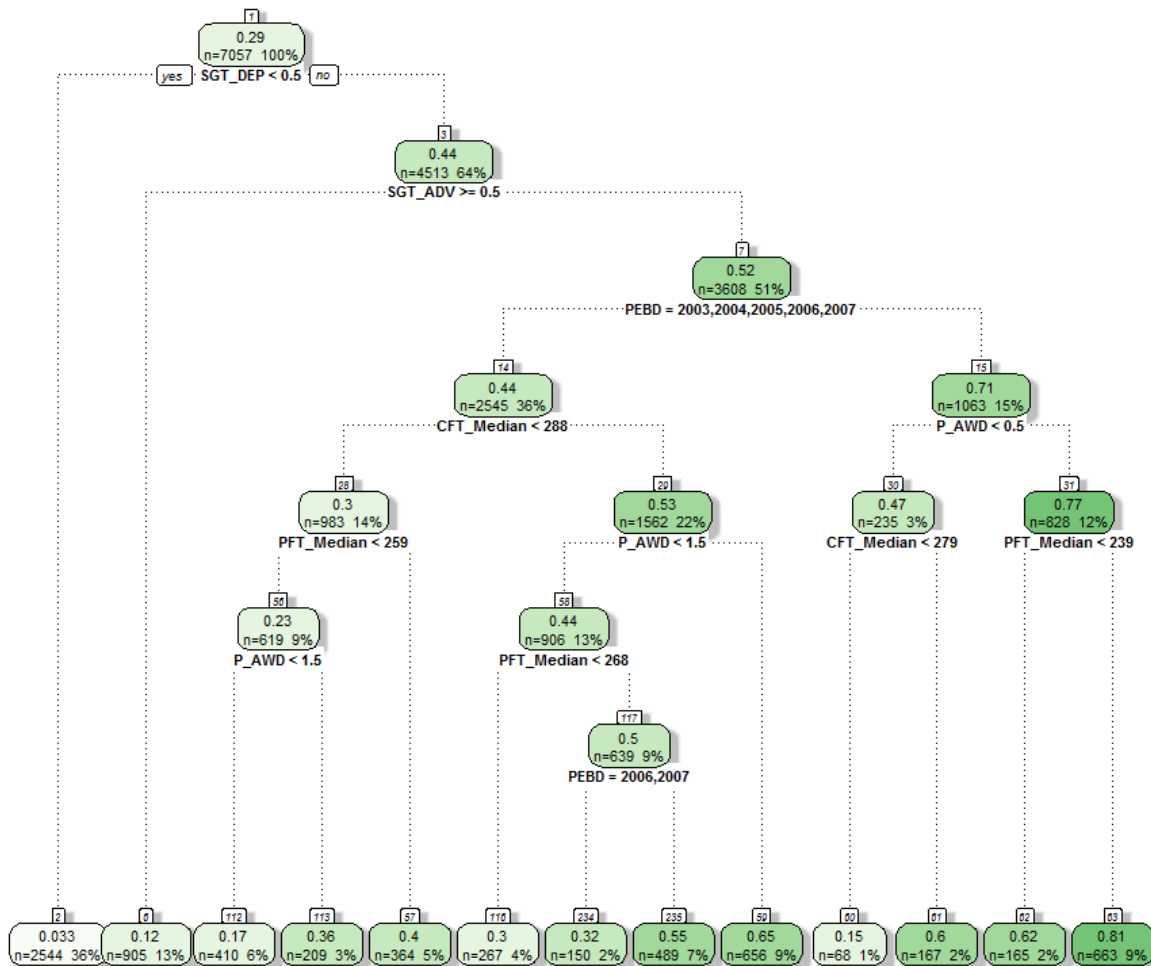
Pruned tree for prediction of promotion for the rank of sergeant with all predictor values included indicating important predictor splits. Tree branches occur at the number of deployments (SGT_DEP), reporting senior values (Median_RSRV), adverse fitness reports (SGT_ADV), PEBD, CFT scores (CFT_Median), PFT scores (PFT_Median), and reviewing officer values (Median_ROCV).

Figure 18. Classification and Regression Tree with All Predictors Included for Promotion from Sergeant to Staff Sergeant (2001 to 2007)

2. Classification and Regression Tree without Performance Variables

Upon removing the reporting senior and reviewing officer factors we compute the prediction model for sergeants. From the top of the tree in Figure 19 we observe SGT_DEP as the initial split with 36% of the sergeant sample with zero deployments and a 3% probability of promotion. For those with at least one deployment (64% of the sample) the next split is to adverse fitness reports. Those sergeants that deploy at least once and get at least one adverse fitness report (13% of sergeants) have a 12% probability of promotion. This find is astonishing, to gain a 9% increase a sergeant needs to deploy and can perform to the degree that earns an adverse report. Those sergeants joining the Marine Corps from 2001 or 2002 have the greatest probability of promotion (81%) if they also have at least one award and PFT_Median scores above 239. With the absence of reporting senior and reviewing officer scores the number of deployments, physical training events scores, PEBD and personal awards demonstrate their importance.

Sergeant Promotion Pruned Tree: Without Reporting Senior or Reviewing Officer



Pruned tree for prediction of promotion for the rank of sergeant with reporting senior and reviewing officer values removed indicating important predictor splits. Tree branches occur at the number of deployments (SGT_DEP), adverse fitness reports (SGT_ADV), PEBD, PFT scores (PFT_Median), CFT scores (CFT_Median), and the number of personal awards (P_AWD).

Figure 19. Classification and Regression Tree with Reporting Senior and Reviewing Officer Values Removed as Predictors for Promotion from Sergeant to Staff Sergeant (2001 to 2007)

Comparing the two models as in Table 15 we find that both have the same classification probabilities. Both correctly classify those Marines that promote with a probability of 80% and those that do not promote with a probability of 77%. From this we conclude the inclusion of the reporting senior and reviewing officer values do not improve the correct classification rate.

Table 15. Test Set Estimated Correct Classification for Sergeant Retention and Promotion

Sergeant (E-5): Fitness Report System				
	All Predictors		RS/RO Values Removed	
	Promote	Not Promote	Promote	Not Promote
Optimal Threshold Value	> .26	≤ .26	> .29	≤ .29
Estimated Correct Prediction Probability	0.80	0.77	0.80	0.77

3. Proportion of Sergeants Promoted by Performance Quadrant

From Table 16 we observe that the quadrants for reporting senior reviewing officer values from the performance evaluation system. We note that that the values represent a more reasonable high to low performance breakdown, roughly (40, 35, 20, 5). While not quite precisely the (50, 30, 18, 2) breakdown, they are very close. The flexibility allotted to the Marine Corps through the competitive nature of the promotion process for sergeants to staff sergeants is a significant force shaping mechanism and appears to be successful.

Table 16. Proportion of Sergeants Promoted Annually by Quadrant

Sergeant Reporting Senior P(Quadrant Prom) by Year									
Quadrant	RSRV Range	2001	2002	2003	2004	2005	2006	2007	Average
LOW	00.00 to 88.09	0.09	0.07	0.04	0.03	0.08	0.09	0.06	7%
MID-LOW	88.09 to 90.4	0.22	0.23	0.22	0.19	0.23	0.23	0.22	22%
MID-HIGH	90.40 to 92.75	0.35	0.32	0.35	0.34	0.30	0.30	0.33	33%
HIGH	92.75 to 100	0.33	0.38	0.39	0.44	0.39	0.38	0.39	39%
Sergeant Reviewing Officer P(Quadrant Prom) by Year									
Quadrant	ROCV Range	2001	2002	2003	2004	2005	2006	2007	Average
LOW	-5.0 to -.26	0.09	0.07	0.06	0.05	0.07	0.09	0.07	7%
MID-LOW	-.26 to .25	0.23	0.24	0.21	0.19	0.23	0.24	0.22	22%
MID-HIGH	.25 to .75	0.31	0.32	0.31	0.33	0.31	0.31	0.31	31%
HIGH	.75 to 5.0	0.37	0.37	0.42	0.43	0.39	0.36	0.40	39%

To further develop intuition about proportionality promotions from each quadrant we observe Figure 20 (reporting senior) and Figure 21 (reviewing officer). From these we find that the fitness report system is proportionally promoting sergeants according to increased performance as expected. From the reporting senior HIGH quadrant, we observe values above 35% for each year and from the LOW quadrant we see averages as low as 5%. These proportions are more in line with expectations than those observed for the lance corporal and corporal ranks. When we consider all Marines ranked below

average by their reporting senior, we observe an overall proportion of 29% for sergeants promoted. While the promotion system appears to be promoting quality better than the corporal and below ranks, there is still 29% of proportional opportunity to promote from the above average sergeants.

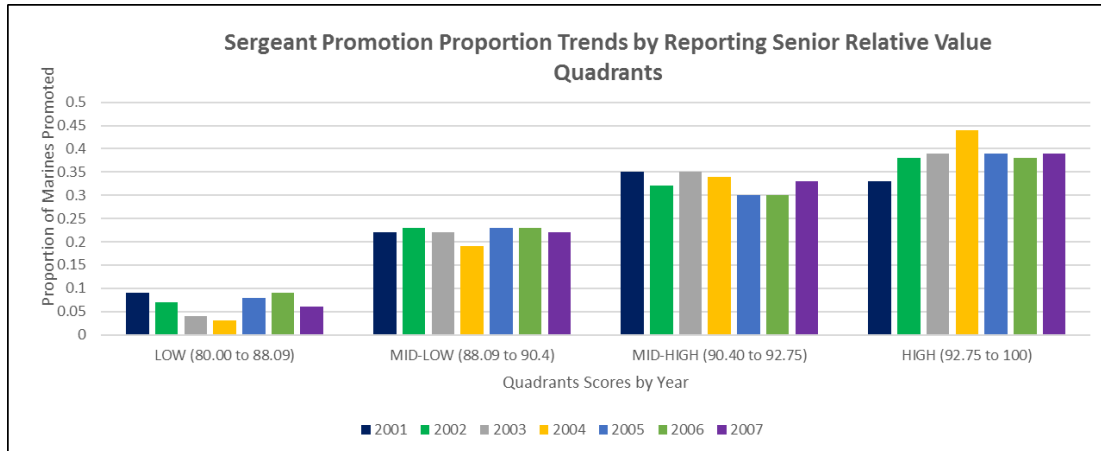


Figure 20. Sergeant Promotion Proportion Trends by Reporting Senior Quadrants

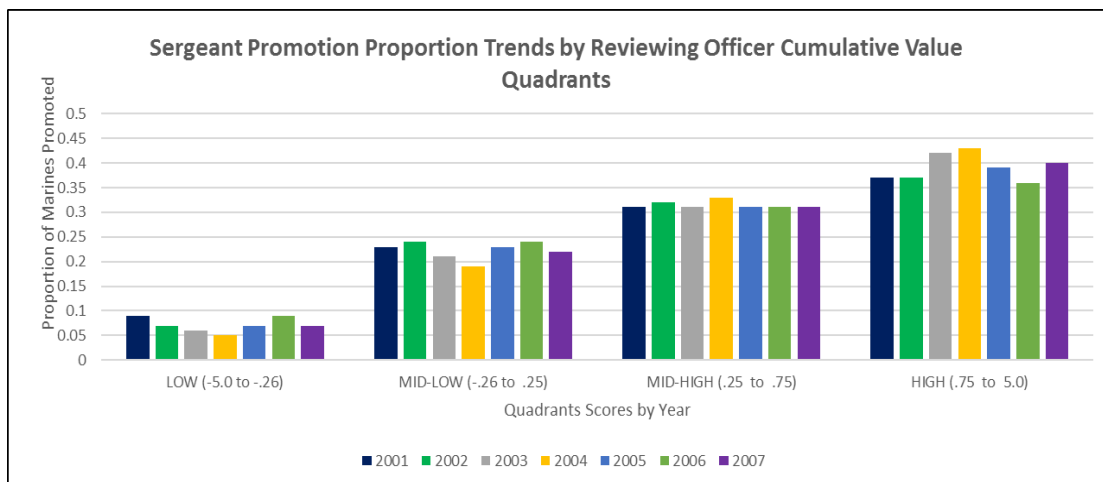


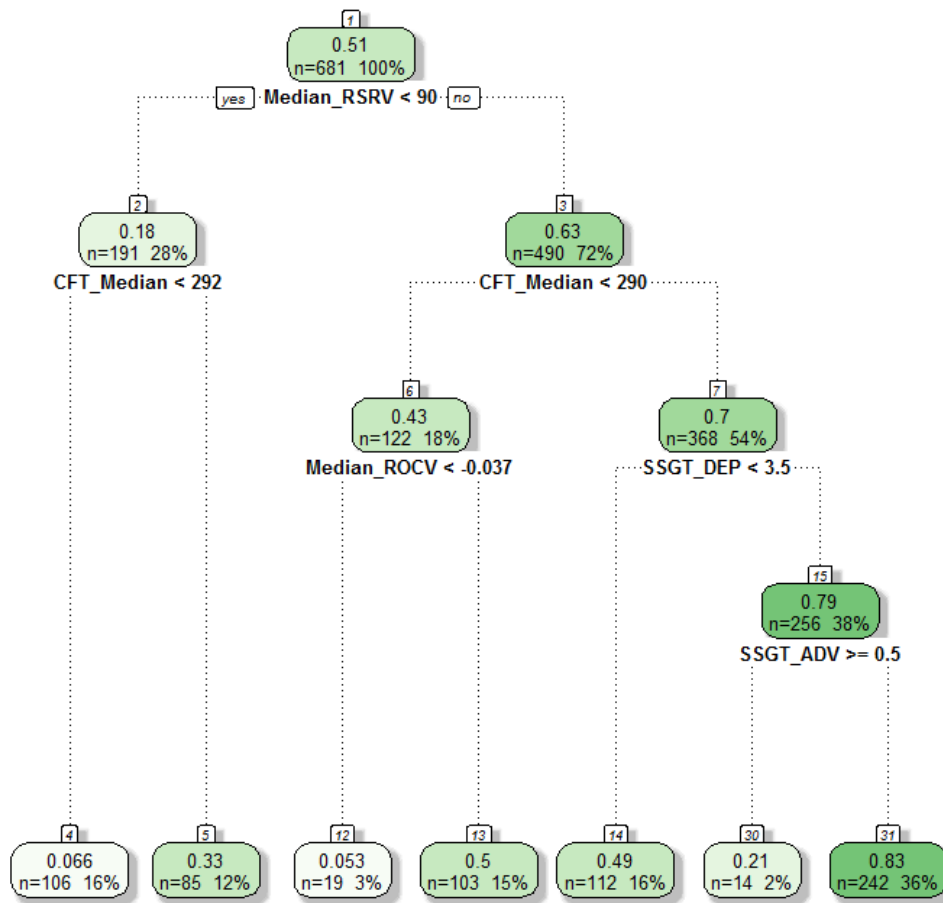
Figure 21. Sergeant Promotion Proportions Trends by Reviewing Officer Quadrants

D. STAFF SERGEANT (WITH PEBD 2001 TO 2004)

1. Classification and Regression Tree Prediction with All Variables

From the 693 staff sergeants observed 358 promote resulting in a probability of promotion of 50%. From Figure 22 we see that the first split is at the Median_RSRV value of 90 indicating average and below average Marines using the reporting senior values. Those staff sergeants with Median_RSRV scores less than 90 (28% proportionally) have a 18% probability of promoting. Those Median_RSRV scores greater than 90, CFT_Medians greater than 290, more than 4 SSGT_DEP (deployments) and zero SSGT_ADV (adverse fitness reports) have a probability of promotion of 83% and account for 36% of the population. This singular track is of particular interest because this is the highest quality Marine produced from the study. To provide guidance to a young Marine about the best things they can do to improve their chances of promotion we would state: The Marine Corps historically promotes staff sergeants that are above average on all fitness reports, get a high CFT score each year, do not receive any adverse fitness reports and deploy at least once at every rank.

Staff Sergeant Promotion Pruned Tree: All Predictors



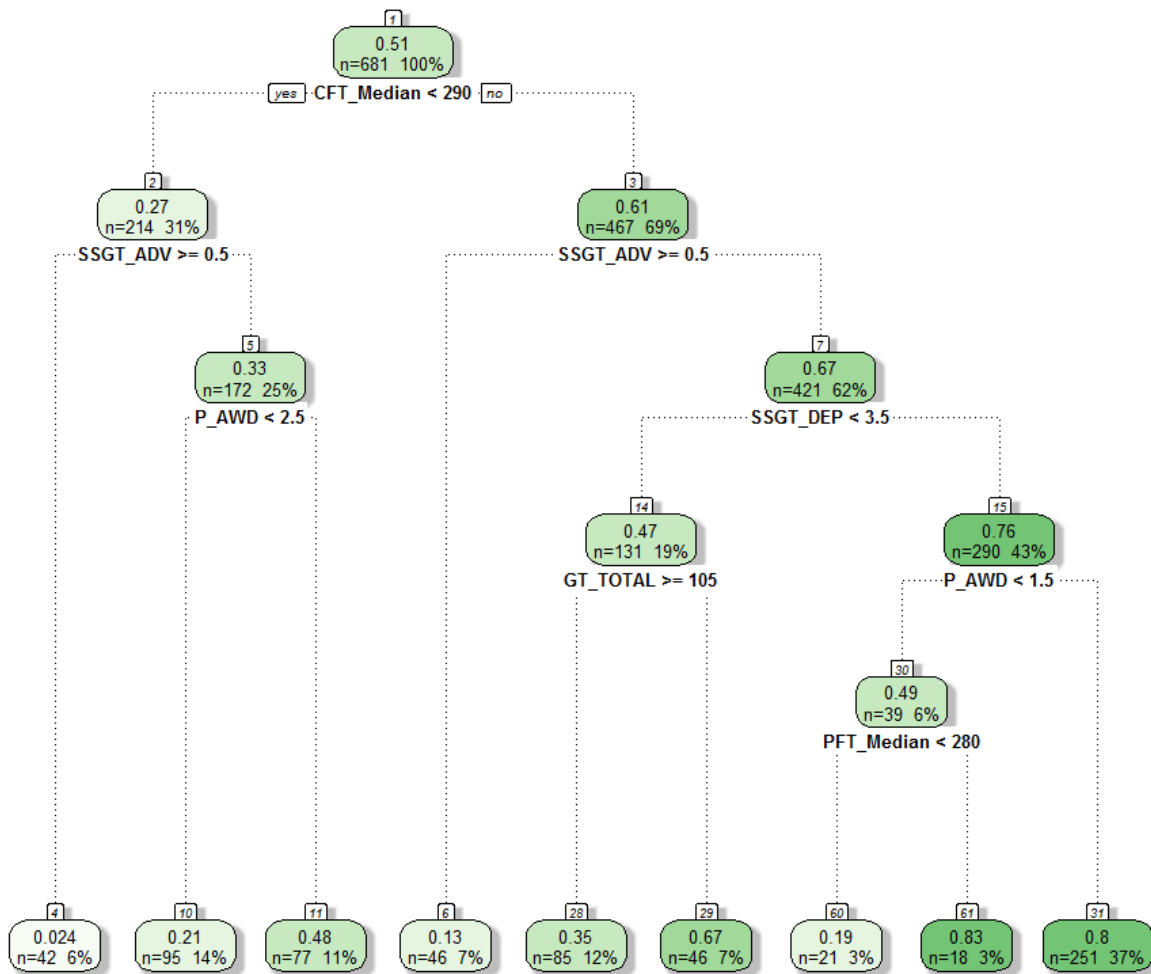
Staff Sergeant promotion tree with all predictors included indicating important promotion predictor splits. Notice the top predictors are reporting senior relative values, CFT scores, reviewing officer cumulative value, number of deployments and adverse fitness reports.

Figure 22. Classification and Regression Tree with All Predictors Included for Promotion from Staff Sergeant to Gunnery Sergeant (2001 to 2004)

2. Classification and Regression Tree without Performance Variables

To interpret the effect that performance variables have on predicting promotion we remove them from the model and re-run the CART. From Figure 23 we observe that the first split is on CFT_Median greater than or equal to 290. Those staff sergeants with at less than a 290 CFT_Median and at least one adverse fitness reports (6% proportionally) have 2% probability of promoting. Those Marines above a 290 CFT_Median, zero adverse fitness reports, four deployments, and two or more awards comprise 37% of sergeants promoted and have an 80% probability of promotion.

Staff Sergeant Promotion Pruned Tree: Without Reporting Senior or Reviewing Officer



Pruned tree for prediction of promotion for the rank of staff sergeant with reporting senior and reviewing officer values removed indicating important predictor splits. Tree branches occur at CFT scores (CFT_Median), adverse fitness reports (SGT_ADV), the number of deployments (SSGT_DEP), the number of personal awards (P_AWD), GT score (GT_TOTAL) and PFT scores (PFT_Median).

Figure 23. Classification and Regression Tree with Reporting Senior and Reviewing Officer Values Removed as Predictors for Promotion from Staff Sergeant to Gunnery Sergeant (2001 to 2004)

When comparing the two prediction models for staff sergeants we find that removing the performance variables improves the predictability of the model as observed in Table 17. The model with reporting senior and reviewing officer values correctly predicts promotion with a 63% probability while predicting those Marines that do not promote with a 68% probability. Conversely after removing the performance variables

from the model prediction improves to a 68% probability of correctly predicting promotion and 70% for those that do not promote. From these we find that the inclusion of the performance variables does not improve the prediction model when determining whether a Marine will promote or not.

Table 17. Test Set Estimated Correct Classification for Staff Sergeant Retention and Promotion

Staff Sergeant (E-6): Fitness Report System				
	All Predictors		RS/RO Values Removed	
	Promote	Not Promote	Promote	Not Promote
Optimal Threshold Value	>.47	≤.47	>.56	≤.56
Estimated Correct Prediction Probability	0.63	0.68	0.68	0.70

3. Proportion of Staff Sergeants Promoted by Performance Quadrant

From Table 18 we note that nearly two thirds of the those promoted come from the top two MID-HIGH and HIGH quadrants. The proportion of staff sergeants that promoted to gunnery sergeant promote to a 30, 35, 25, 10 breakdown from high to low performance quadrants. The staff sergeant promotion process appears to be less effective observed in the previous rank (sergeants: 40, 35, 20, 5 breakdown). From this we note that the staff sergeant to gunnery sergeant promotion process does not promote proportionally as well as the sergeant to staff sergeant promotion process.

Table 18. Staff Sergeant Promotion Proportions by Quadrant

Staff Sergeant Reporting Senior P(Quadrant Prom) by Year						
Quadrant	RSRV Range	2001	2002	2003	2004	Average
LOW	00.00 to 90.51	0.08	0.08	0.13	0.05	9%
MID-LOW	90.51 to 92.7	0.23	0.22	0.27	0.32	26%
MID-HIGH	92.70 to 96.1	0.36	0.35	0.31	0.36	35%
HIGH	96.10 to 100	0.33	0.35	0.29	0.27	31%

Staff Sergeant Reviewing Officer P(Quadrant Prom) by Year						
Quadrant	ROCV Range	2001	2002	2003	2004	Average
LOW	-5.0 to -.17	0.08	0.08	0.13	0.09	10%
MID-LOW	-.17 to .5	0.24	0.23	0.27	0.36	28%
MID-HIGH	.5 to 1.0	0.33	0.31	0.29	0.27	30%
HIGH	1.0 to 5.0	0.35	0.38	0.31	0.27	33%

From Figures 24 and 25 we observe the proportions of staff sergeants promoted from 2001 to 2004. From the LOW and MID-LOW quadrants, we note an increase over time while the opposite is true for the MID-HIGH and HIGH performing quadrants. The decreasing trend indicates a higher attrition of top performing Marines while more below average Marines promote.

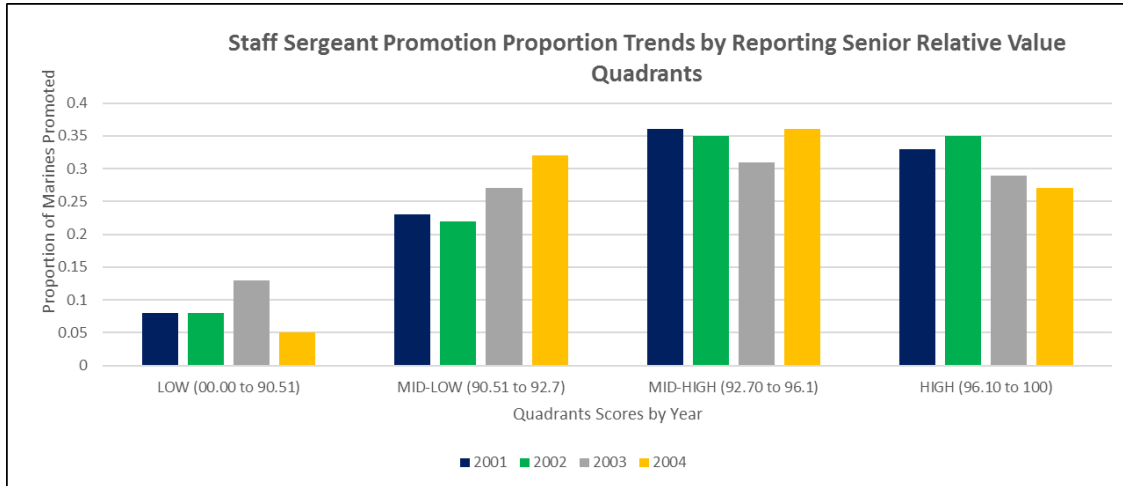


Figure 24. Staff Sergeant Promotion Trends by Reporting Senior Quadrants

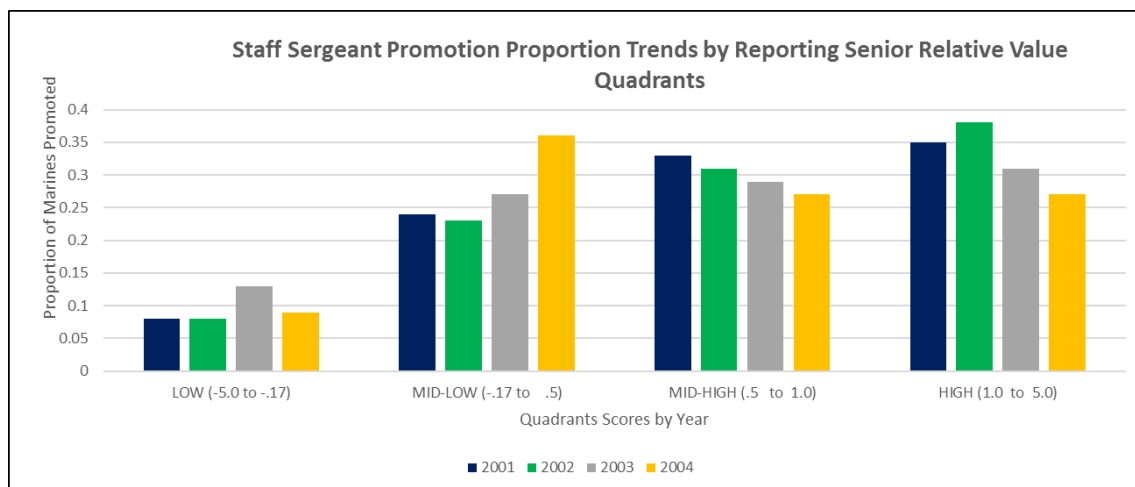


Figure 25. Staff Sergeant Promotion Trends by Reviewing Officer Quadrants

E. RESULTS SUMMARY

To gain an overall assessment for each rank we identify the greatest contributing factors for the highest and lowest probabilities associated with retention and promotion. From Table 19 we observe that most frequent factors across all ranks are performance evaluation, deployments, negative paperwork and physical fitness. Next we summarize the effect that policy is having for each rank. For lance corporals to have the highest probabilities for retaining and promoting they should have conduct scores above 4.3, PFT scores over 240 and at least one deployment. Corporals should have conduct scores above 4.3 and at least one deployment. Sergeants should have at least one deployment, above average reporting senior values, and zero adverse fitness reports.

Table 19. Important Factors for Marines that Promote and Fail to Promote by Rank

Conclusions: Most Important Factors for Promotion					
Rank (# Marines)	Lance Corporal (31312)	Corporal (26840)	Sergeant (7893)	Staff Sergeant (773)	
Greatest Probability for Promoting	81% Conduct > 4.3	49% Deployment > .5	43% Deployments > .5	62% RSRV > 90	
	86% PFT > 240	95% Conduct > 4.3	58% RSRV > 90	69% CFT > 290	
	96% Deployments > .5		62% Adverse < .5	78% Deployments > 4	
Least Probability for Promoting	53% Conduct < 4.3	24% Deployments < .5	3% Deployments < .5	18% RSRV < 90	
	36% Conduct < 4.2	15% Conduct < 4.5	21% RSRV < 90	8% CFT < 292	
	20% PFT < 263	11% PFT < 265	5% Adverse > .5	2% Adverse > .5	

We next summarize the performance quadrants by rank and the two performance metrics from each performance system. From Figure 25 we note that the bottom quadrant accounts for 6% to 13% of Marines across the ranks and evaluation systems, the lower-middle performing Marines account for 22% to 36% of Marines, upper-middle 26% to 36% and top performing Marines account for 18% to 39% of Marines promoted. The inconsistency of the above specified ranges indicates disparity between the two systems. From the left side of the figure we observe more LOW and MID-LOW performance while to the right we note more MID-HIGH and HIGH performance. Those ranks associated with fitness reports proportionally promote 14% more from the top performing Marines then those using proficiency and conduct system. This tells us that the proportion of high quality Marines is better represented using fitness report scores than using

proficiency and conduct scores. From this we conclude that the Marine Corps relies heavily on identifying quality from reporting senior and reviewing officer values and less so for proficiency and conduct scores.

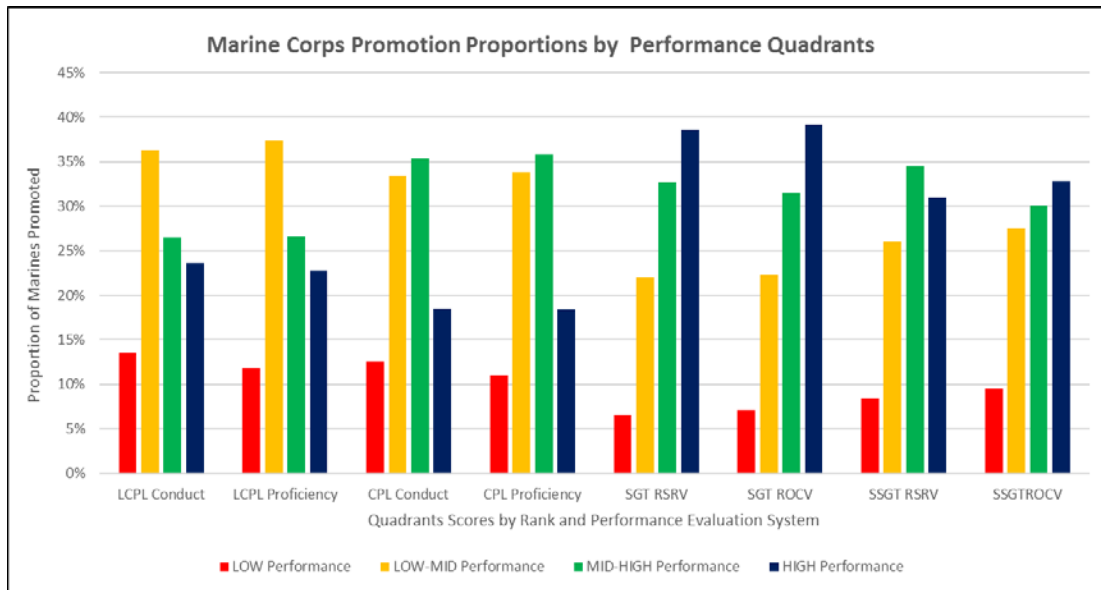


Figure 26. USMC Promotion Proportions by Performance and Rank

V. CONCLUSIONS

A. OVERVIEW

Our thesis identifies important factors that explain differences in the probabilities of promotion for enlisted infantry Marines across four ranks: lance corporal to corporal, corporal to sergeant, sergeant to staff sergeant, and staff sergeant to gunnery sergeant. From the classification and regression trees we find that performance evaluation, number of deployments, physical fitness, adverse fitness reports and awards play an important role in determining the likelihood of retaining and promoting. We then remove performance evaluation parameters and identify where the resulting prediction model improves or degrades in the probability of correctly predicting promotion. It was found that the performance evaluation parameters only improve lance corporal predictions.

From the data we determine the proportion of high quality Marines that promote across four performance quadrants derived from proficiency and conduct values, reporting senior relative values and reviewing officer cumulative values. From these we consider trends for each quadrant by rank and performance metric and compare these to what we expect them to be. We then compute the probability of promoting from each performance quadrant by rank.

B. CONCLUSIONS

Throughout our comparison of the two methods used for performance evaluation we find that proportionally more high quality Marines are promoted using fitness reports and the promotion board process than the proficiency and conduct and composite score process. The low proportions of high quality Marines promoted as a result of proficiency and conduct process presents an issue. Neither the proficiency and conduct method or the fitness report scores method for promoting result in retaining and promoting 100% from the top two quadrants. Perhaps the goal for retention and promotion should fall closer to a (50, 30, 18, 2) proportional high to low performance breakdown. The closest rank that achieves the proportional split is sergeants.

1. Research Objectives

The main objective of this thesis is to develop an understanding about which factors influence probabilities of promotion for enlisted infantry Marines. Additionally, the thesis identifies the proportion of Marines promoted from performance quadrants and the probability of promoting from each quadrant. Finally, the thesis compares the two performance evaluation models and the results they proportionally produce across performance quadrants.

2. Research Questions

In Chapter I a set of research questions are presented, which our findings address as follows:

What factors influence the promotion process by rank? We find that the primary prediction variables for each rank are the performance variables (proficiency and conduct marks, and reporting senior, reviewing officer values) and physical fitness (CFT and PFT scores). For the proficiency and conduct system scores we observe the value of 4.3 as a natural split. For CFT scores we observe splits between 283 to 290 across the ranks while splits for PFT scores range mostly from 239 to 265 across the ranks. For lance corporals and corporals, we observe that high rifle scores, the number of deployments, GT scores and awards contribute toward promotion. For the ranks of sergeant and staff sergeant we observe fitness reports, awards and deployments to be the prevailing promotion prediction factors. Fitness reports generally split just above average with reporting senior relative values splitting between median scores of 89 and 90 (range 80 to 100) and reviewing officer cumulative values splitting between .17 and 0.44 (range -5 to 4). We observe adverse fitness reports decrease probabilities for promotion for both ranks observed. The most important prediction factor for promotion to sergeant and staff sergeant is having at least one deployment even with an adverse fitness report.

What proportion of Marines are promoted from the bottom, lower-middle, upper-middle and top performance evaluation quadrants by rank? The Marine Corps promotes 5% to 15% from the lowest performing quadrant of Marines across all ranks. The opportunity to retain and promote more from the top 50% and top 25%

performance evaluated Marines from proficiency, conduct, reporting senior and reviewing officer values exists.

How do the two performance evaluation systems compare? From proficiency/conduct scores and reporting senior/reviewing officer scores, we observe that the proficiency and conduct method promotes more bottom performing and less top performing Marines than the reporting senior and reviewing officer scores. Despite this the classification and regression trees reveal similarities across the two evaluation methods, such as the number of deployments and the importance of the performance evaluation variables. While the performance inclusion changes the ability to correctly predict those that retain and promote or not by rank it is clear that performance parameters are present in all classification and regression trees and therefore important.

C. RECOMMENDATIONS

Based on our conclusions we believe that the Marine Corps promotes a low proportion of enlisted infantry Marines with above average proficiency and conduct marks. Proportionally, the fitness report and board process promotes more high quality Marines. Consider altering the proficiency and conduct system to achieve the effects that the fitness report system has on proportional retention and promotion. While fitness reports for 160 thousand Marines may be difficult for officers to complete, an approach involving non-commissioned officers may provide relief. In order to achieve proportional understanding it is necessary to first determine what proportion from each quadrant is reasonable. A policy that promotes 50%, 30%, 18% and 2% of Marines from high, mid-high, mid-low and low performing quadrants respectively does seem reasonable. Comparing other military occupational specialties proportional levels will provide a solid baseline. To get close to the aforementioned breakdown it is necessary to understand why high quality junior enlisted infantry Marines get out of the Marine Corps and then to focus retention efforts toward retaining these high quality Marines.

From the classification and regression trees we observe the effects that Marine Corps policy has over time. This insight allows the Marine Corps to validate if the policy is having the effect desired. Deployments identify as important factors for promotion

across the ranks. This may not be causation and requires further analysis to determine the necessity that having at least one deployment has on promotions.

Throughout the analysis we identify interesting ways of interpreting each Marines data. For personal awards we observe a proportionally low amount for the lower ranking Marines while purple hearts are proportionally high. The Marines taking the risk should be recognized the most. Policy governing awards should better reflect the outstanding work and risk that junior Marines provide. For proficiency and conduct marks we note the discrete nature of the values used which if expanded would allow better performance classification for Marines. This could be accomplished through refined guidance in the IRAM. We also note the effect of increasing promotion zones and the proportion of Marines promoted based on the PEBD factor. Incentivizing higher quality Marines through monetary means, quality of life measures, key desired billets, early moves, or performance based rewards all provide alternate means for retaining and promoting more high quality Marines and should be considered. Lastly we note the utility of using the accumulated data method. By assessing a Marine based off all of their data we create a more accurate representation of their quality. The whole Marine concept recognizes each Marines self-development consistency, which could lead to less personal management and should be integrated as necessary.

D. FUTURE WORK

The factors identified as important, should have their levels interpreted and studied. The distribution of each factor needs to be analyzed for requirement validation to ensure Marines are being evaluated in a manner that contributes to desired areas of improvement. From these findings it is necessary to define quality and determine the ideal proportion of quality desired and required. It should also include analysis for determining better means for increasing force structure during times of war (vice widening the zones for promotion and therefore reducing standards, a larger reserve pool, or by influencing retention for high quality Marines).

APPENDIX A. MARINE CORPS FITNESS REPORT TEMPLATE

USMC FITNESS REPORT (1610) NAVMC 10835 (Rev. 7-11) (EF) PREVIOUS EDITIONS WILL NOT BE USED FOUO - Privacy sensitive when filled in.										COMMANDANT'S GUIDANCE										DO NOT STAPLE THIS FORM									
The completed fitness report is the most important information component in manpower management. It is the primary means of evaluating a Marine's performance and is the Commandant's primary tool for the selection of personnel for promotion, augmentation, resident schooling, command, and duty assignments. Therefore, the completion of this report is one of an officer's most critical responsibilities. Inherent in this duty is the commitment of each Reporting Senior and Reviewing Officer to ensure the integrity of the system by giving close attention to accurate marking and timely reporting. Every officer serves a role in the scrupulous maintenance of this evaluation system, ultimately important to both the individual and the Marine Corps. Inflationary markings only serve to dilute the actual value of each report. Reviewing Officers will not concur with inflated reports.																													
A. ADMINISTRATIVE INFORMATION																													
1. Marine Reported On: a. Last Name b. First Name c. MI d. SSN e. Grade f. DOR g. PMOS h. BILMOS																													
2. Organization: a. MCC b. RUC c. Unit Description																													
3. Occasion and Period Covered: a. OCC b. From To c. Type																													
4. Duty Assignment (descriptive title):																													
5. Special Case: a. Adverse ☐ b. Not Observed ☐ c. Extended ☐																													
6. Marine Subject Of: a. Commendatory Material ☐ b. Derogatory Material ☐ c. Disciplinary Action ☐																													
7. Recommended For Promotion: a. Yes ☐ b. No ☐ c. N/A ☐																													
8. Special Information: a. QUAL ☐ d. HT(In.) ☐ b. PFT ☐ e. WT ☐ c. CFT ☐ f. Body Fat ☐ g. Reserve Component ☐ h. Status ☐ i. Future Use ☐																													
9. Duty Preference: a. Code b. Descriptive Title 1st ☐ 2nd ☐ 3rd ☐																													
10. Reporting Senior: a. Last Name b. Init c. Service d. SSN e. Grade f. Duty Assignment																													
11. Reviewing Officer: a. Last Name b. Init c. Service d. SSN e. Grade f. Duty Assignment																													
B. BILLET DESCRIPTION																													
C. BILLET ACCOMPLISHMENTS																													

1. Marine Reported On:				2. Occasion and Period Covered:			
a. Last Name		b. First Name		c. MI		d. SSN	
D. MISSION ACCOMPLISHMENT							
1. PERFORMANCE: Results achieved during the reporting period. How well those duties inherent to a Marine's billet, plus all additional duties, formally and informally assigned, were carried out. Reflects a Marine's aptitude, competence, and commitment to the unit's success above personal reward. Indicators are time and resource management, task prioritization, and tenacity to achieve positive ends consistently.							
ADV	Meets requirements of billet and additional duties. Aptitude, commitment, and competence meet expectations. Results maintain status quo.	Consistently produces quality results while measurably improving unit performance. Habitually makes effective use of time and resources; improves billet procedures and products. Positive impact extends beyond billet expectations.	Results far surpass expectations. Recognizes and exploits new resources, creates opportunities. Emulated; sought after as an expert with influence beyond unit. Impact significant; innovative approaches to problems produce significant gains in quality and efficiency.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
2. PROFICIENCY: Demonstrates technical knowledge and practical skill in the execution of the Marine's overall duties. Combines training, education and experience. Translates skills into actions which contribute to accomplishing tasks and missions. Imparts knowledge to others. Grade dependent.							
ADV	Competent. Possesses the requisite range of skills and knowledge commensurate with grade and experience. Understands and articulates basic functions related to mission accomplishment.	Demonstrates mastery of all required skills. Expertise, education and experience consistently enhance mission accomplishment. Innovative troubleshooter and problem solver. Effectively imparts skills to subordinates.	True expert in field. Knowledge and skills impact far beyond those of peers. Translates broad-based education and experience into forward thinking, innovative actions. Makes immeasurable impact on mission accomplishment. Peerless teacher. Selflessly imparts expertise to subordinates, peers, and seniors.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
JUSTIFICATION:							
E. INDIVIDUAL CHARACTER							
1. COURAGE: Moral or physical strength to overcome danger, fear, difficulty or anxiety. Personal acceptance of responsibility and accountability, placing conscience over competing interests regardless of consequences. Conscious, overriding decision to risk bodily harm or death to accomplish the mission or save others. The will to persevere despite uncertainty.							
ADV	Demonstrates inner strength and acceptance of responsibility commensurate with scope of duties and experience. Willing to face moral or physical challenges in pursuit of mission accomplishment.	Guided by conscience in all actions. Proven ability to overcome danger, fear, difficulty or anxiety. Exhibits bravery in the face of adversity and uncertainty. Not deterred by morally difficult situations or hazardous responsibilities.	Uncommon bravery and capacity to overcome obstacles and inspire others in the face of moral dilemma or life-threatening danger. Demonstrated under the most adverse conditions. Selfless. Always places conscience over competing interests regardless of physical or personal consequences.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
2. EFFECTIVENESS UNDER STRESS: Thinking, functioning and leading effectively under conditions of physical and/or mental pressure. Maintaining composure appropriate for the situation, while displaying steady purpose of action, enabling one to inspire others while continuing to lead under adverse conditions. Physical and emotional strength, resilience and endurance are elements.							
ADV	Exhibits discipline and stability under pressure. Judgment and effective problem-solving skills are evident.	Consistently demonstrates maturity, mental agility and willpower during periods of adversity. Provides order to chaos through the application of intuition, problem-solving skills, and leadership. Composure reassures others.	Demonstrates seldom-matched presence of mind under the most demanding circumstances. Stabilizes any situation through the resolute and timely application of direction, focus and personal presence.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
3. INITIATIVE: Action in the absence of specific direction. Seeing what needs to be done and acting without prompting. The instinct to begin a task and follow through energetically on one's own accord. Being creative, proactive and decisive. Transforming opportunity into action.							
ADV	Demonstrates willingness to take action in the absence of specific direction. Acts commensurate with grade, training and experience.	Self-motivated and action-oriented. Foresight and energy consistently transform opportunity into action. Develops and pursues creative, innovative solutions. Acts without prompting. Self-starter.	Highly motivated and proactive. Displays exceptional awareness of surroundings and environment. Uncanny ability to anticipate mission requirements and quickly formulate original, far-reaching solutions. Always takes decisive, effective action.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
JUSTIFICATION:							
NAVMC 10835 (Rev. 7-11) (EF) FOR OFFICIAL USE ONLY - Privacy sensitive when filled in. PAGE 2 OF 5							

1. Marine Reported On:				2. Occasion and Period Covered:			
a. Last Name		b. First Name		c. MI		d. SSN	
				a. OCC		b. From To	
F. LEADERSHIP							
1. LEADING SUBORDINATES. The inseparable relationship between leader and led. The application of leadership principles to provide direction and motivate subordinates. Using authority, persuasion and personality to influence subordinates to accomplish assigned tasks. Sustaining motivation and morale while maximizing subordinates' performance.							
ADV	Engaged; provides instructions and directs execution. Seeks to accomplish mission in ways that sustain motivation and morale. Actions contribute to unit effectiveness.	Achieves a highly effective balance between direction and delegation. Effectively tasks subordinates and clearly delineates standards expected. Enhances performance through constructive supervision. Fosters motivation and enhances morale. Builds and sustains teams that successfully meet mission requirements. Encourages initiative and candor among subordinates.	Promotes creativity and energy among subordinates by striking the ideal balance of direction and delegation. Achieves highest levels of performance from subordinates by encouraging individual initiative. Engenders willing subordination, loyalty, and trust that allow subordinates to overcome their perceived limitations. Personal leadership fosters highest levels of motivation and morale, ensuring mission accomplishment even in the most difficult circumstances.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
2. DEVELOPING SUBORDINATES. Commitment to train, educate, and challenge all Marines regardless of race, religion, ethnic background, or gender. Mentorship. Cultivating professional and personal development of subordinates. Developing team players and esprit de corps. Ability to combine teaching and coaching. Creating an atmosphere tolerant of mistakes in the course of learning.							
ADV	Maintains an environment that allows personal and professional development. Ensures subordinates participate in all mandated development programs.	Develops and institutes innovative programs, to include PME, that emphasize personal and professional development of subordinates. Challenges subordinates to exceed their perceived potential thereby enhancing unit morale and effectiveness. Creates an environment where all Marines are confident to learn through trial and error. As a mentor, prepares subordinates for increased responsibilities and duties.	Widely recognized and emulated as a teacher, coach and leader. Any Marine would desire to serve with this Marine because they know they will grow personally and professionally. Subordinate and unit performance far surpassed expected results due to MRO's mentorship and team building talents. Attitude toward subordinate development is infectious, extending beyond the unit.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
3. SETTING THE EXAMPLE. The most visible facet of leadership: how well a Marine serves as a role model for all others. Personal action demonstrates the highest standards of conduct, ethical behavior, fitness, and appearance. Bearing, demeanor, and self-discipline are elements.							
ADV	Maintains Marine Corps standards for appearance, weight, and uniform wear. Sustains required level of physical fitness. Adheres to the tenets of the Marine Corps core values.	Personal conduct on and off duty reflects highest Marine Corps standards of integrity, bearing and appearance. Character is exceptional. Actively seeks self-improvement in wide-ranging areas. Dedication to duty and professional example encourage others' self-improvement efforts.	Model Marine, frequently emulated. Exemplary conduct, behavior, and actions are tone-setting. An inspiration to subordinates, peers, and seniors. Remarkable dedication to improving self and others.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
4. ENSURING WELL-BEING OF SUBORDINATES. Genuine interest in the well-being of Marines. Efforts enhance subordinates' ability to concentrate on unit mission accomplishment. Concern for family readiness is inherent. The importance placed on welfare of subordinates is based on the belief that Marines take care of their own.							
ADV	Deals confidently with issues pertinent to subordinate welfare and recognizes suitable courses of action that support subordinates' well-being. Applies available resources, allowing subordinates to effectively concentrate on the mission.	Instills and/or reinforces a sense of responsibility among junior Marines for themselves and their subordinates. Actively fosters the development of and uses support systems for subordinates which improve their ability to contribute to unit mission accomplishment. Efforts to enhance subordinate welfare improve the unit's ability to accomplish its mission.	Noticeably enhances subordinates well-being, resulting in a measurable increase in unit effectiveness. Maximizes unit and base resources to provide subordinates with the best support available. Proactive approach serves to energize unit members to "take care of their own," thereby correcting potential problems before they can hinder subordinates' effectiveness. Widely recognized for techniques and policies that produce results and build morale. Builds strong family atmosphere. Puts motto: Mission first, Marines always, into action.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
5. COMMUNICATION SKILLS. The efficient transmission and receipt of thoughts and ideas that enable and enhance leadership. Equal importance given to listening, speaking, writing, and critical reading skills. Interactive, allowing one to perceive problems and situations, provide concise guidance, and express complex ideas in a form easily understood by everyone. Allows subordinates to ask questions, raise issues and concerns and venture opinions. Contributes to a leader's ability to motivate as well as counsel.							
ADV	Skilled in receiving and conveying information. Communicates effectively in performance of duties.	Clearly articulates thoughts and ideas, verbally and in writing. Communication in all forms is accurate, intelligent, concise, and timely. Communicates with clarity and verve, ensuring understanding of intent or purpose. Encourages and considers the contributions of others.	Highly developed facility in verbal communication. Adept in composing written documents of the highest quality. Combines presence and verbal skills which engender confidence and achieve understanding irrespective of the setting, situation, or size of the group addressed. Displays an intuitive sense of when and how to listen.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
JUSTIFICATION:							
NAVMC 10835 (Rev. 7-11) (EF) FOR OFFICIAL USE ONLY - Privacy sensitive when filled in. PAGE 3 OF 5							

1. Marine Reported On:				2. Occasion and Period Covered:			
a. Last Name		b. First Name		c. MI	d. SSN	a. OCC	b. From To
G. INTELLECT AND WISDOM							
1. PROFESSIONAL MILITARY EDUCATION (PME). Commitment to intellectual growth in ways beneficial to the Marine Corps. Increases the breadth and depth of warfighting and leadership aptitude. Resources include resident schools; professional qualifications and certification processes; nonresident and other extension courses; civilian educational institution coursework; a personal reading program that includes (but is not limited to) selections from the Commandant's Reading List; participation in discussion groups and military societies; and involvement in learning through new technologies.							
ADV	Maintains currency in required military skills and related developments. Has completed or is enrolled in appropriate level of PME for grade and level of experience. Recognizes and understands new and creative approaches to service issues. Remains abreast of contemporary concepts and issues.	PME outlook extends beyond MOS and required education. Develops and follows a comprehensive personal program which includes broadened professional reading and/or academic course work; advances new concepts and ideas.	Dedicated to life-long learning. As a result of active and continuous efforts, widely recognized as an intellectual leader in professionally related topics. Makes time for study and takes advantage of all resources and programs. Introduces new and creative approaches to service issues. Engages in a broad spectrum of forums and dialogues.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
2. DECISION MAKING ABILITY. Viable and timely problem solution. Contributing elements are judgment and decisiveness. Decisions reflect the balance between an optimal solution and a satisfactory, workable solution that generates tempo. Decisions are made within the context of the commander's established intent and the goal of mission accomplishment. Anticipation, mental agility, intuition, and success are inherent.							
ADV	Makes sound decisions leading to mission accomplishment. Actively collects and evaluates information and weighs alternatives to achieve timely results. Confidently approaches problems; accepts responsibility for outcomes.	Demonstrates mental agility; effectively prioritizes and solves multiple complex problems. Analytical abilities enhanced by experience, education, and intuition. Anticipates problems and implements viable, long-term solutions. Steadfast, willing to make difficult decisions.	Widely recognized and sought after to resolve the most critical, complex problems. Seldom matched analytical and intuitive abilities; accurately foresees unexpected problems and arrives at well-timed decisions despite fog and friction. Completely confident approach to all problems. Masterfully strikes a balance between the desire for perfect knowledge and greater tempo.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
3. JUDGMENT. The discretionary aspect of decision making. Draws on core values, knowledge, and personal experience to make wise choices. Comprehends the consequences of contemplated courses of action.							
ADV	Majority of judgments are measured, circumspect, relevant and correct.	Decisions are consistent and uniformly correct, tempered by consideration of their consequences. Able to identify, isolate and assess relevant factors in the decision making process. Opinions sought by others. Subordinates personal interest in favor of impartiality.	Decisions reflect exceptional insight and wisdom beyond this Marine's experience. Counsel sought by all; often an arbiter. Consistent, superior judgment inspires the confidence of seniors.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
JUSTIFICATION:							
H. FULFILLMENT OF EVALUATION RESPONSIBILITIES							
1. EVALUATIONS. The extent to which this officer serving as a reporting official conducted, or required others to conduct, accurate, uninflated, and timely evaluations.							
ADV	Occasionally submitted untimely or administratively incorrect evaluations. As RS, submitted one or more reports that contained inflated markings. As RO, concurred with one or more reports from subordinates that were returned by HQMC for inflated marking.	Prepared uninflated evaluations which were consistently submitted on time. Evaluations accurately described performance and character. Evaluations contained no inflated markings. No reports returned by RO or HQMC for inflated marking. No subordinates' reports returned by HQMC for inflated marking. Few, if any, reports were returned by RO or HQMC for administrative errors. Section Cs were void of superlatives. Justifications were specific, verifiable, substantive, and where possible, quantifiable and supported the markings given.	No reports submitted late. No reports returned by either RO or HQMC for administrative correction or inflated markings. No subordinates' reports returned by HQMC for administrative correction or inflated markings. Returned procedurally or administratively incorrect reports to subordinates for correction. As RO nonconcurred with all inflated reports.				N/O
A	B	C	D	E	F	G	H
☐	☐	☐	☐	☐	☐	☐	☐
JUSTIFICATION:							
NAVMC 10835 (Rev. 7-11) (EF) FOR OFFICIAL USE ONLY - Privacy sensitive when filled in. PAGE 4 OF 5							

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APPENDIX B. MASTER BRIEF SHEET EXAMPLE

MASTER BRIEF SHEET

PAGE 1 OF 1
CREATED: 12 DEC 2005

***** ADMINISTRATIVE INFORMATION (ORIGINATES FROM MCTFS - CONTACT YOUR ADMIN SECTION FOR CORRECTIONS) *****																																
NAME		SSN	GRADE	RANK	LCN	DOR	TIG	CURRENT DUTY ASSIGNMENT						BILLET DESCRIPTION				DCIB														
MARINE, JOHN S.		123456789	O4	MAJ	12345678	19990501	5yr. 11mo.	US Central Command						J-3 Future Ops Officer				20030717														
KEY DATE SUMMARY		AWARDS			MILITARY OCCUPATIONAL SPECIALTIES								TRAINING SUMMARY				LANGUAGES															
DEAF	19890702	MM	1		PMOS	0302	Infantry Officer	AMOS4							RIFLE	E/340	19980915	1994	French													
TIS	15yr. 11mo.	NC	2		AMOS1		Communications Officer	ACQ							PISTOL	M/340	19980915	1990	Spanish													
PEBD	19890520	NA	1		AMOS2			B MOS							PFT	A/289	20030922															
AFADBD	19890520				AMOS3										MCMAP	TAN	20030815															
OSCD	19950115																															
ACC COMM	19890520																															
DOR COMM	19890531																															
DSG PILOT																																
DCADB																																
EAS	19890520																															
***** PERFORMANCE EVALUATION SUMMARY *****																																
ADMINISTRATIVE SUMMARY										REPORTING SENIOR MARKINGS										REVIEWING OFFICER MARKINGS												
Grade	OC	From	Months	Billet Description		Reporting Senior		Per	Pro	Co	Eff	Ini	Lea	Dev	Set	Ens	Co	PME	Dco	Jud	Eval	Reviewing Officer	RO marks - same grade at processing									
B MOS	Type	To	Com	Adv	Command	Promote	Reports	RPT Avg	RS Avg	Rs High	RPT at High	RV at Proc	Cum RV	Obser	Concur	RO marks - same grade cumulative																
Capt	GC	19980801	9		Company Commander	LtCol Stickler		C	C	B	B	C	C	B	C	C	B	B	B	C	H	Col Spreddode	0/1	0/2	1/3	3/4	2/5	1/6	0/7	0/8		
0302	N	19990503	X		1st Battalion 2d Marines	Yes	14 of 17	2.53	2.25	2.82	1	94.60	96.00	Suff	Yes	0/1	1/2	9/3	12/4	23/5	11/6	1/7	0/8									
Maj	CH	19990904	3		Operations Officer	LtCol Smidgen		C	C	C	H	C	C	H	C	H	B	H	C	C	H	Col Spreddode	0/1	0/2	1/3	2/4	2/5	2/6	0/7	0/8		
0302	C	19990801			1st Battalion 2d Marines	Yes	8 of 8	2.88	2.93	3.50	1	89.76	89.76	Suff	Yes	0/1	0/2	2/3	7/4	7/5	5/6	2/7	0/8									
Maj	CH	19990801	6		Operations Officer	LtCol Highmark		D	F	E	C	E	E	D	D	D	D	D	E	E	H	Col Fairmark	0/1	0/2	1/3	3/4	2/5	1/6	0/7	0/8		
0302	C	20000119			1st Battalion 2d Marines	Yes	11 of 16	4.46	5.95	6.38	2	83.70	81.89	Suff	No	1/1	1/2	2/3	4/4	17/5	12/6	7/7	1/8									
Maj	TR	20000120	3		BN Executive Officer	LtCol Solo		B	B	C	B	B	C	B	B	C	B	B	C	B	H	Col Fairmark	0/1	1/2	1/3	3/4	3/5	1/6	0/7	0/8		
0302	N	20000414			1st Battalion 2d Marines	Yes	1 of 1	2.30	2.30	2.30	1	N/A	N/A	Suff	Yes	1/1	1/2	2/3	4/4	17/5	12/6	7/7	1/8									
Maj	CH	20000415	12		Commanding Officer	Col Inflatario		F	F	F	F	E	F	E	E	E	E	D	E	E		BGen Lowbranch	0/1	0/2	3/3	3/4	18/5	20/6	12/7	0/8		
9910	N	20010507	X		MCRS Pittsburg	Yes	21 of 21	5.21	5.12	5.57	1	93.68	93.68	Suff	No	2/1	0/2	0/3	7/4	24/5	26/6	16/7	1/8									
Maj	CH	20010508	14		Commanding Officer	Col Eeplus		F	E	E	E	E	F	E	E	E	E	E	E	E		BGen Toptree	0/1	1/2	0/3	7/4	38/5	17/6	4/7	0/8		
9910	N	20020702			MCRS Pittsburg	Yes	5 of 8	5.14	5.33	5.86	1	83.87	86.44	Suff	Yes	0/1	1/2	0/3	9/4	46/5	19/6	5/7	1/8									
Maj	TR	20020703	12		Commanding Officer	Col Deesmost		C	D	D	D	D	C	D	D	C	D	D	D	D	D	BGen Panzer										
9910	N	20030630	X		MCRS Pittsburg	Yes	7 of 12	3.79	4.42	5.00	1	83.67	80.00	Insuff																		

Figure 28. Marine Corps Master Brief Sheet Example. Source: USMC (2013).

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APPENDIX C. REPORTING SENIOR RELATIVE VALUE CHART

“Grading the Grader” RV is the Fitrep system’s way of compensating for grading differences between Reporting Seniors. Like weighted points in a GPA, RV ensures that all Fitreps are fair and consistent no matter how “tough” or “easy” the individual grader is.

Example Relative Value Chart:

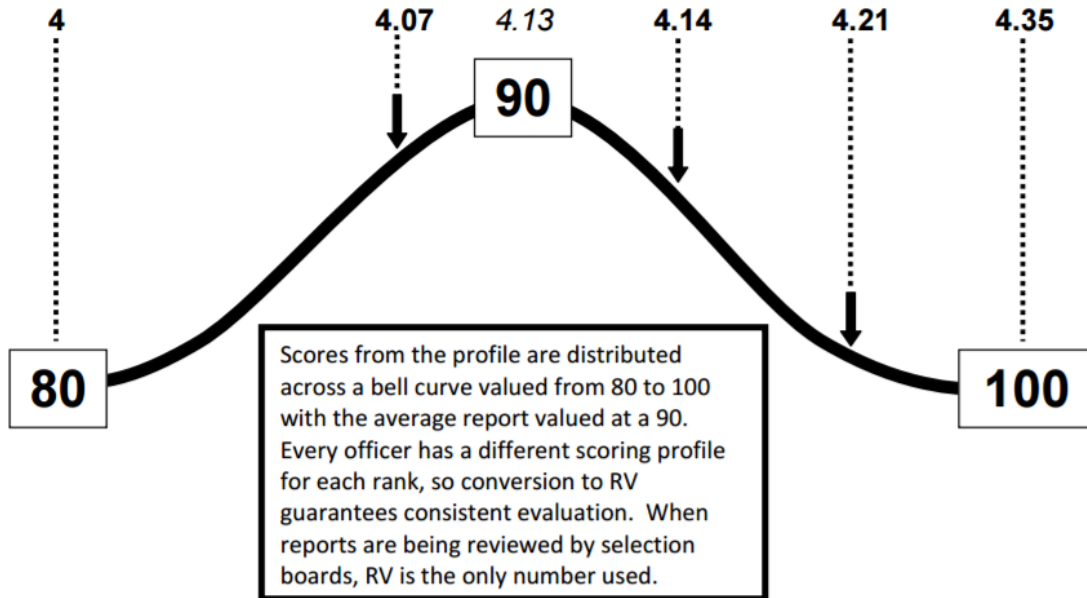


Figure 29. Relative Value Chart. Source: USMC (2015a).

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APPENDIX D. ADDITIONAL CLASSIFICATION TREES

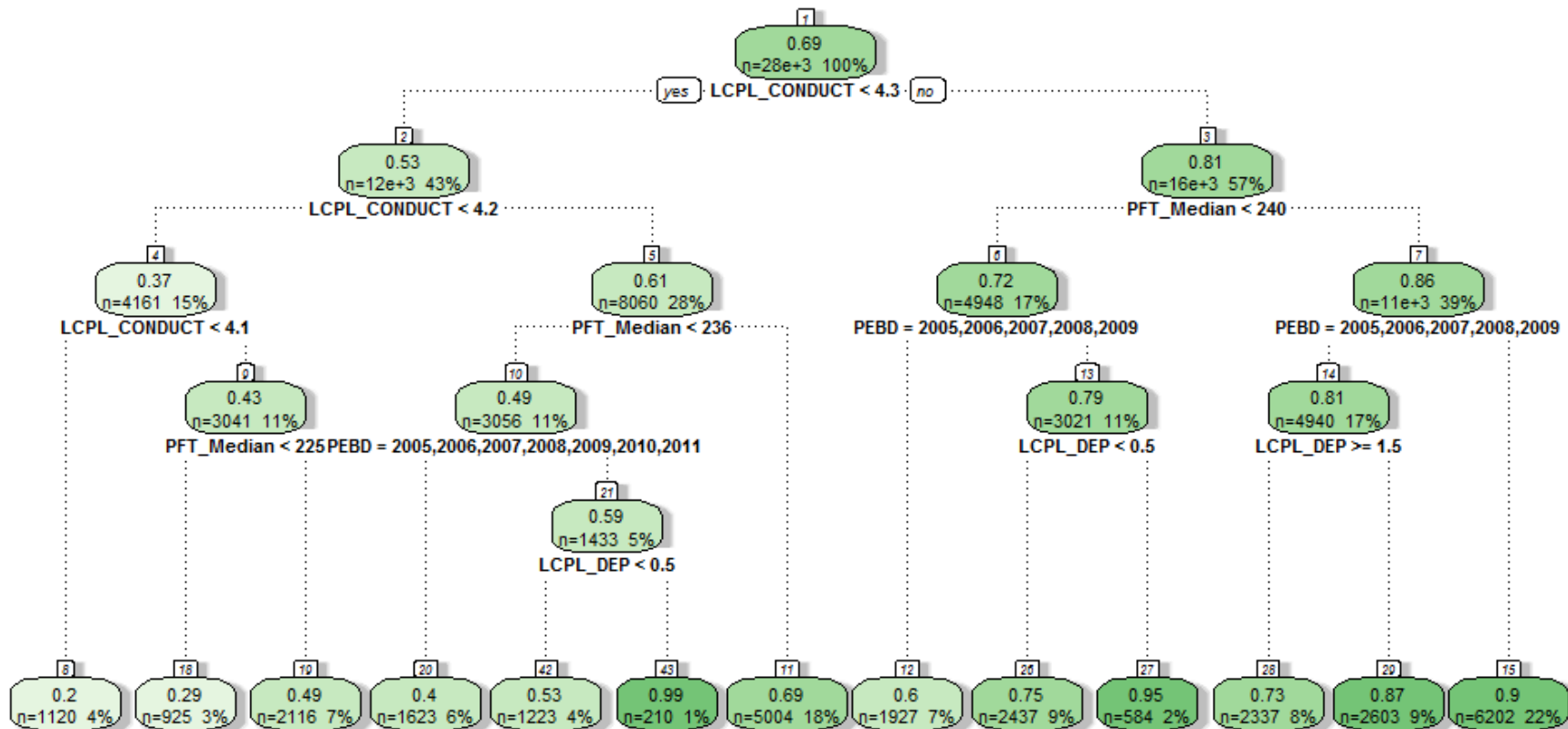


Figure 30. CART for Lance Corporals with All Predictors

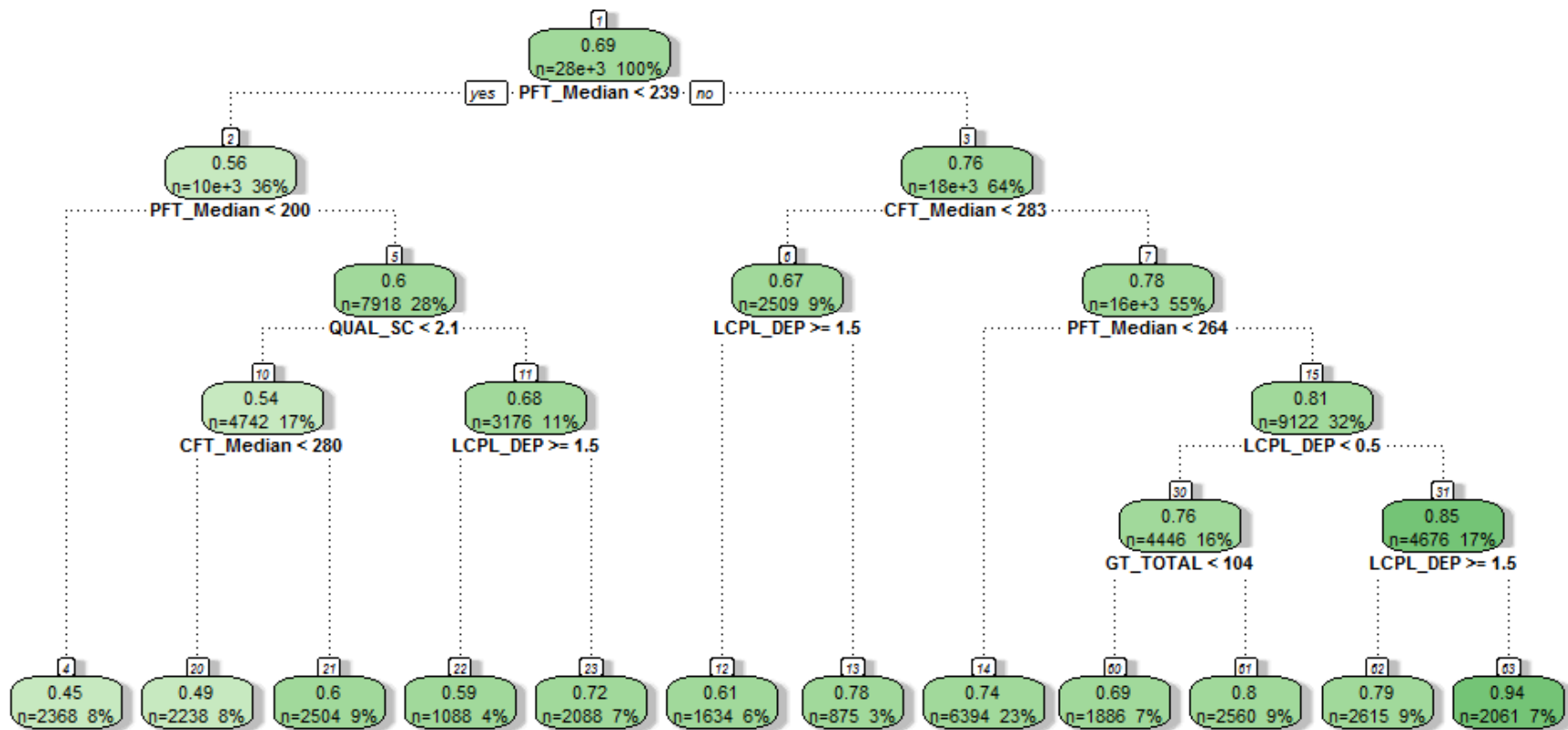


Figure 31. CART for Lance Corporals without Performance Evaluation Predictors

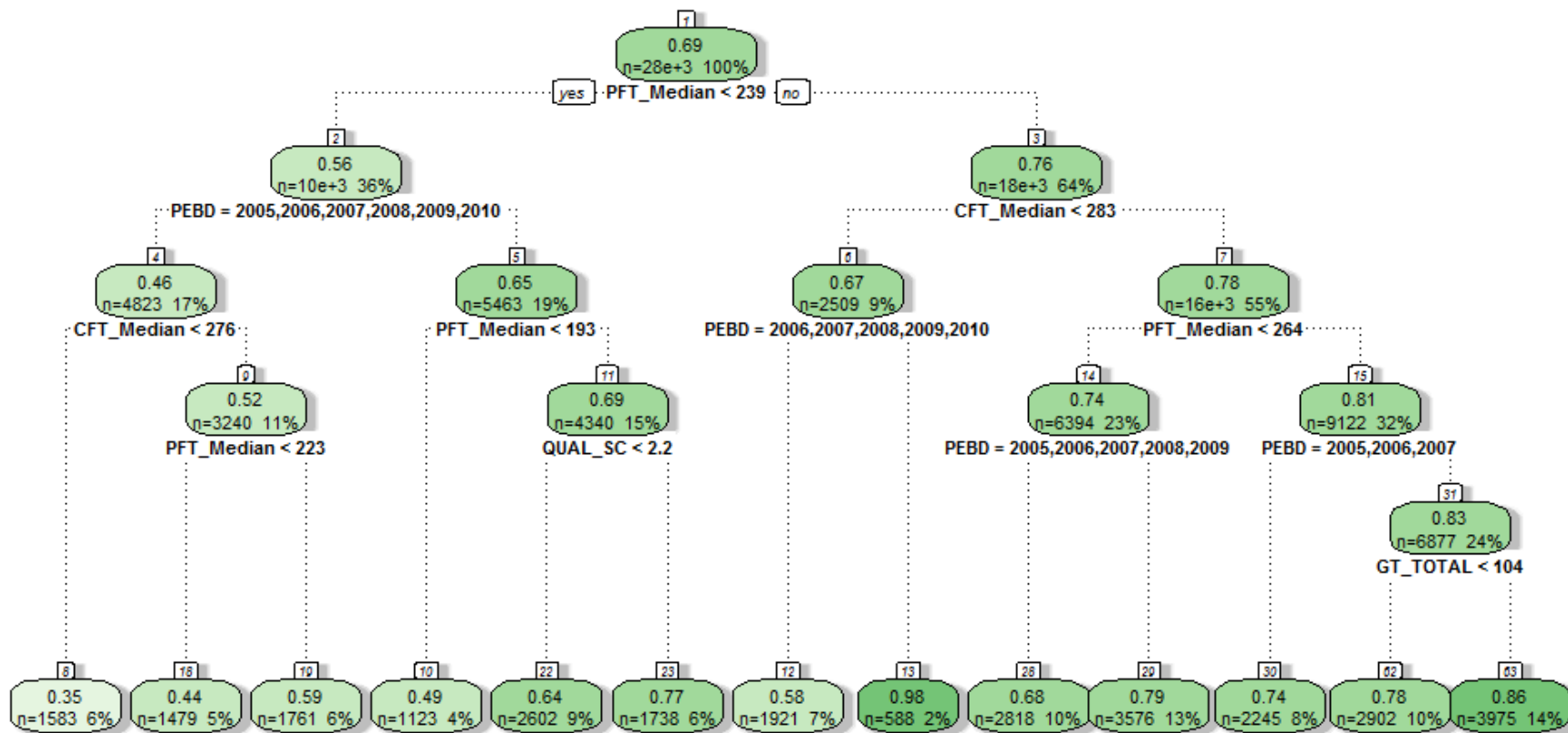


Figure 32. CART for Lance Corporals without Performance or Deployment Predictors

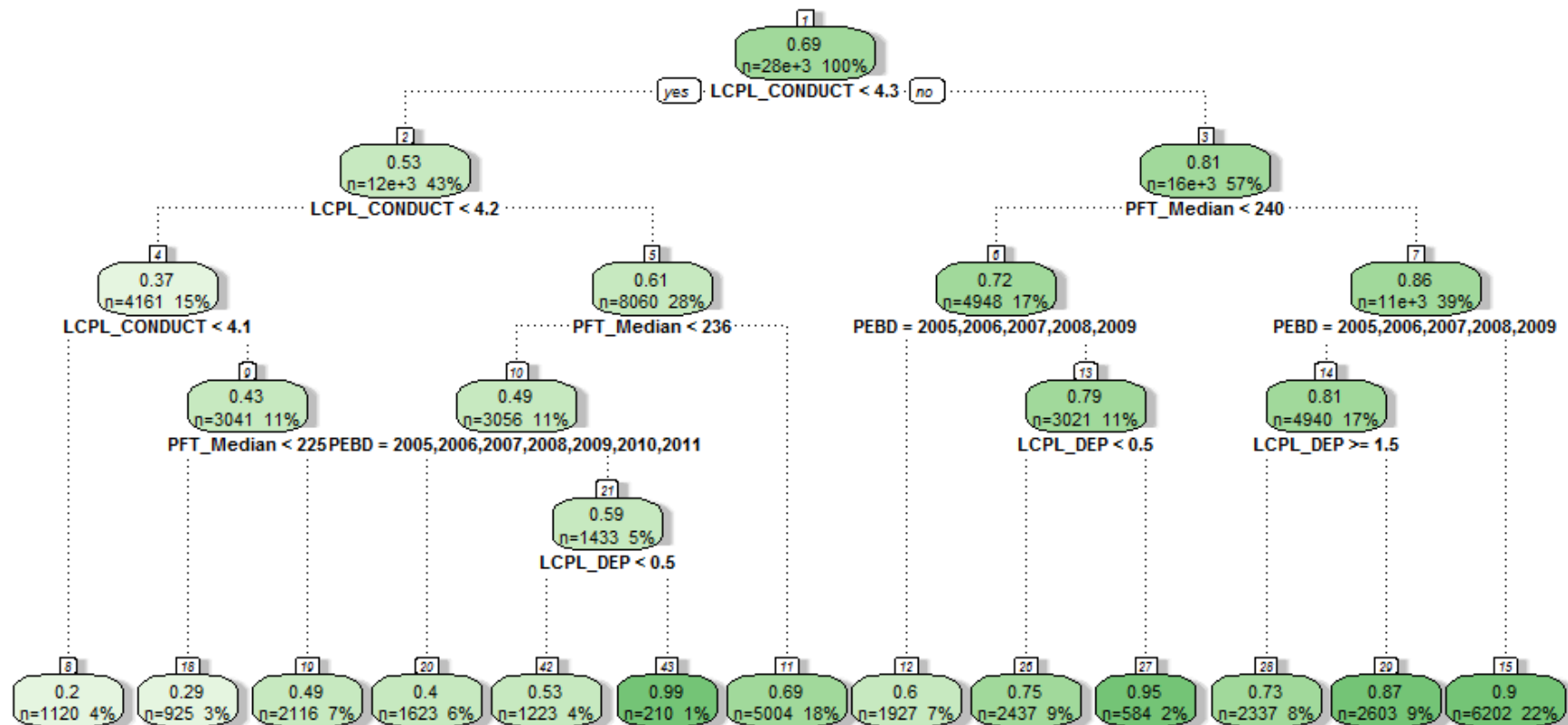


Figure 33. CART for Lance Corporals without CFT Scores

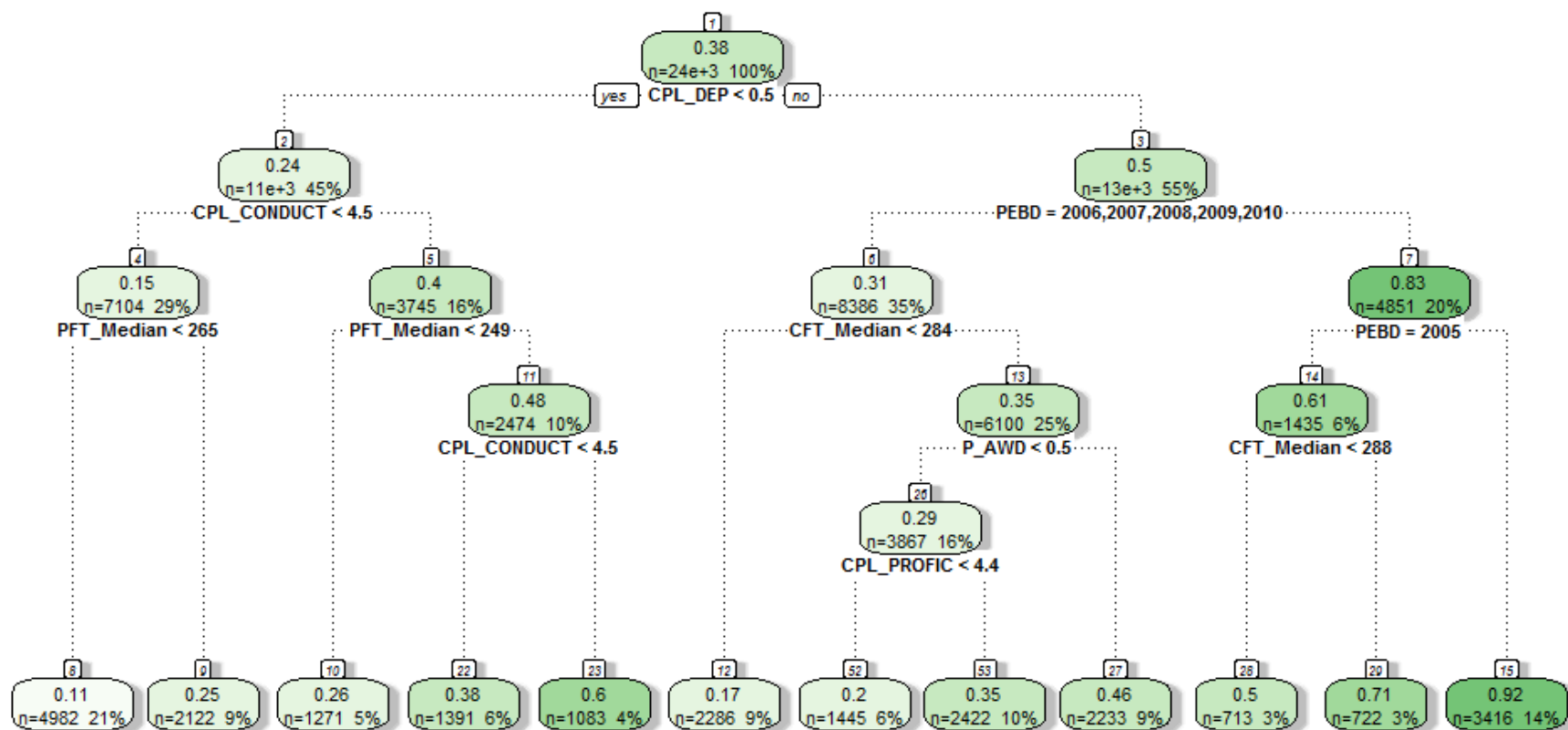


Figure 34. CART for Corporals with All Predictors

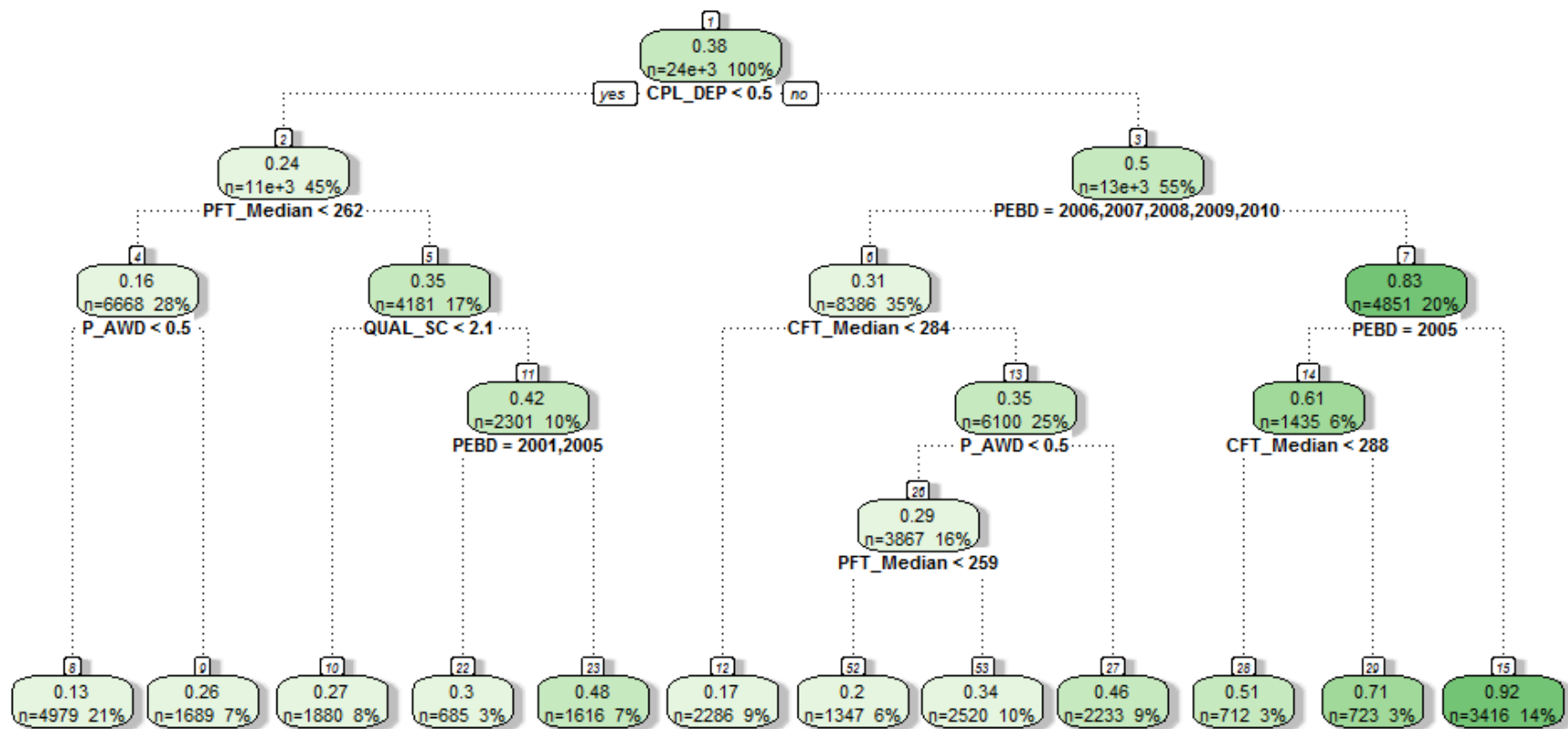


Figure 35. CART for Corporals without Performance Evaluation Predictors

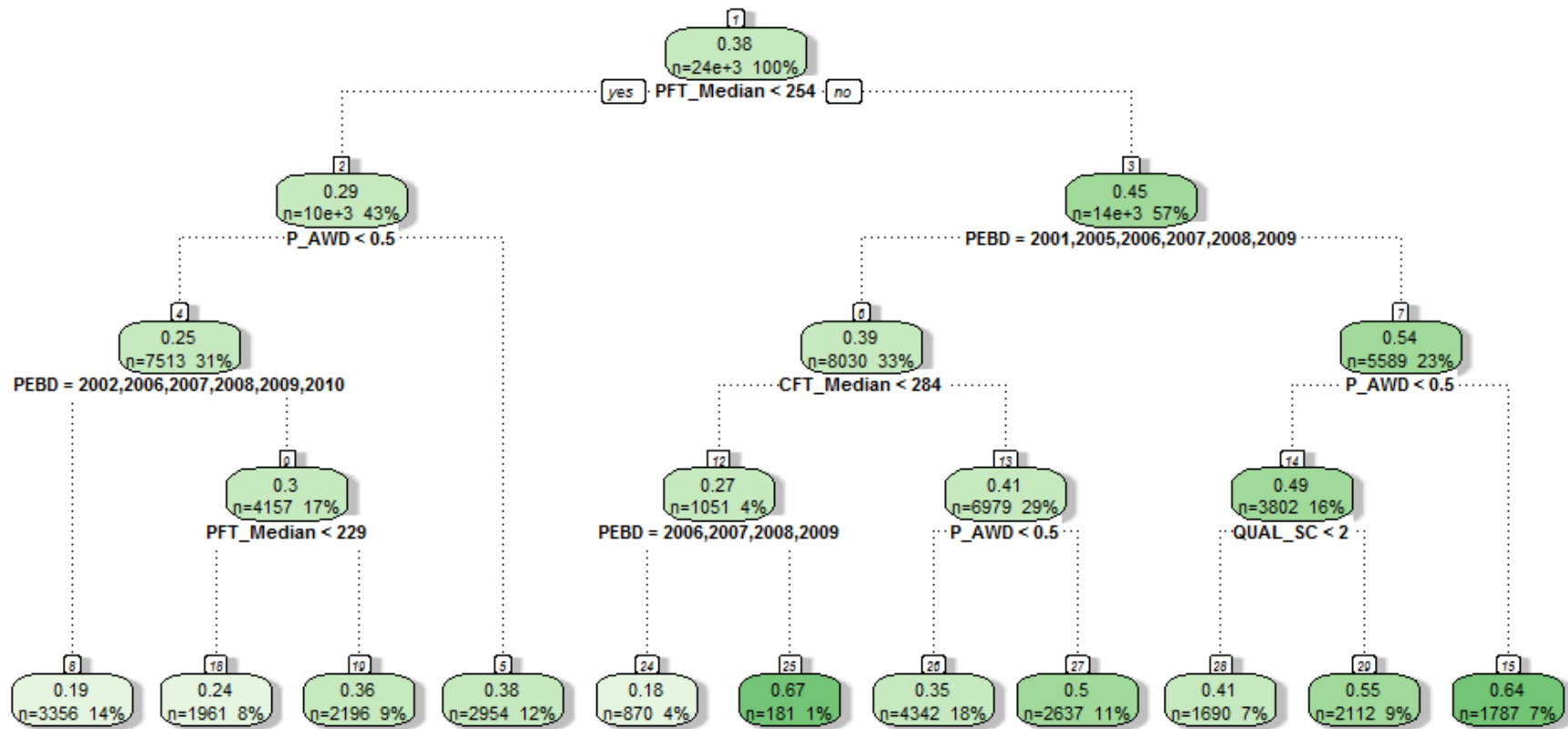


Figure 36. CART for Corporals without Performance or Deployment Predictors

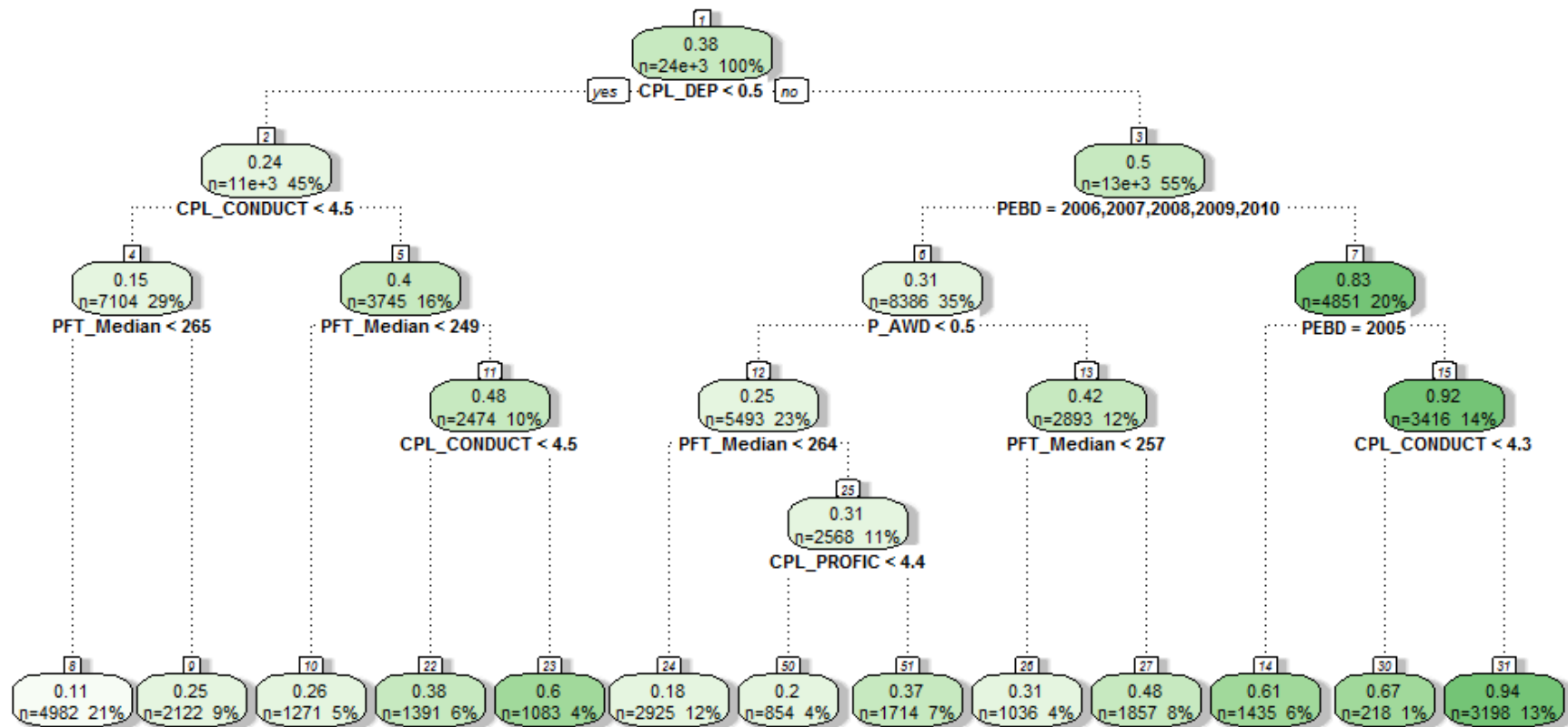


Figure 37. CART for Corporals without CFT Predictors

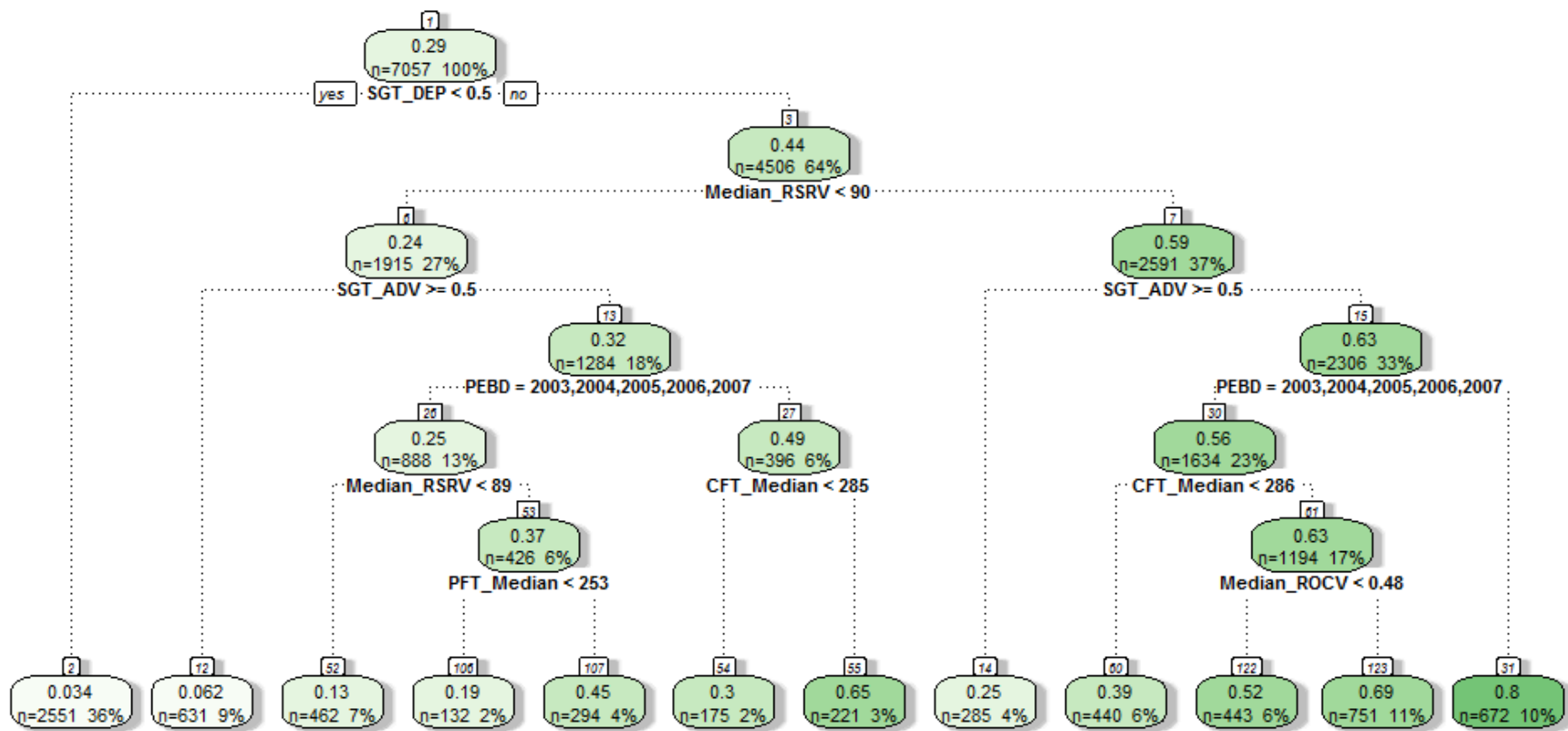


Figure 38. CART for Sergeants with All Predictors

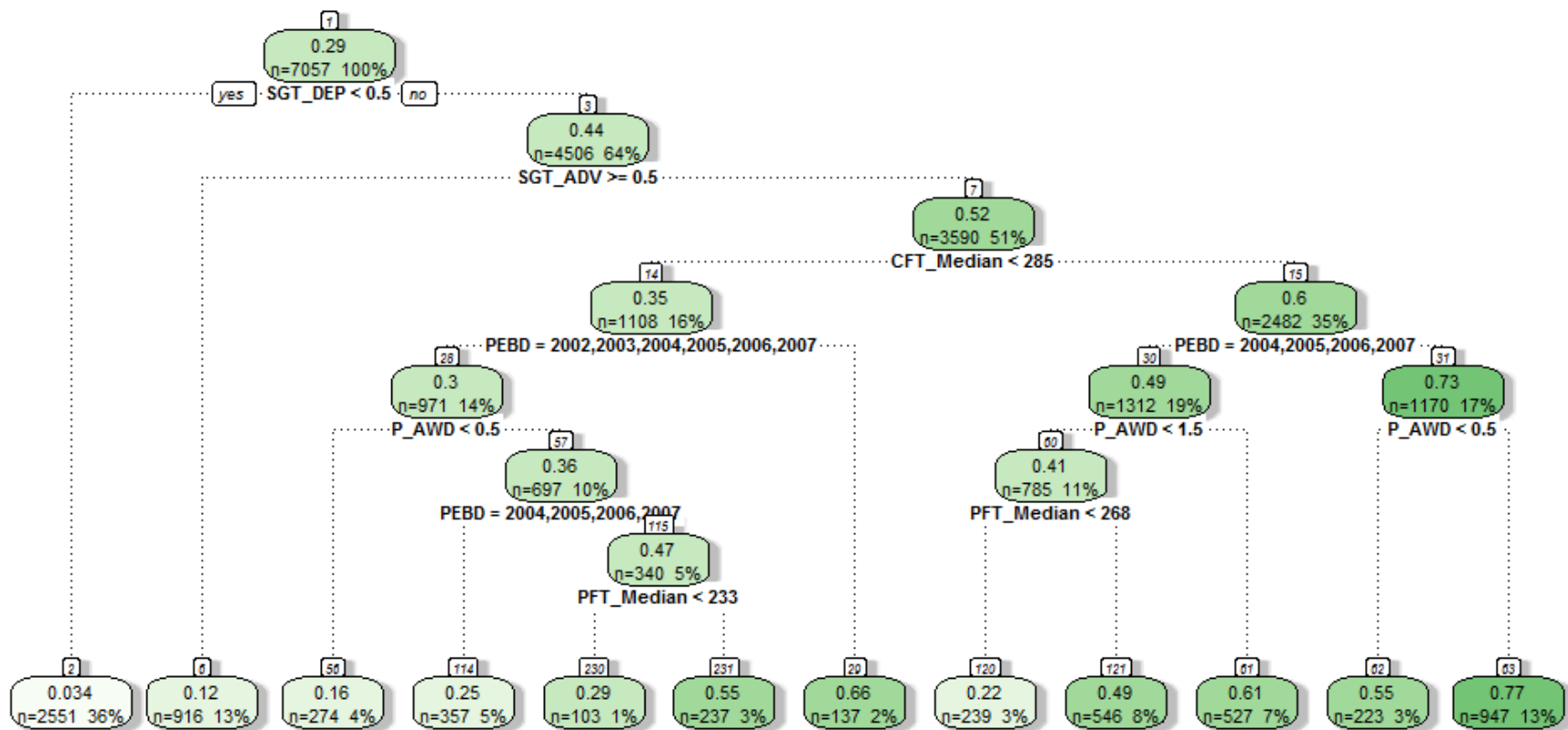
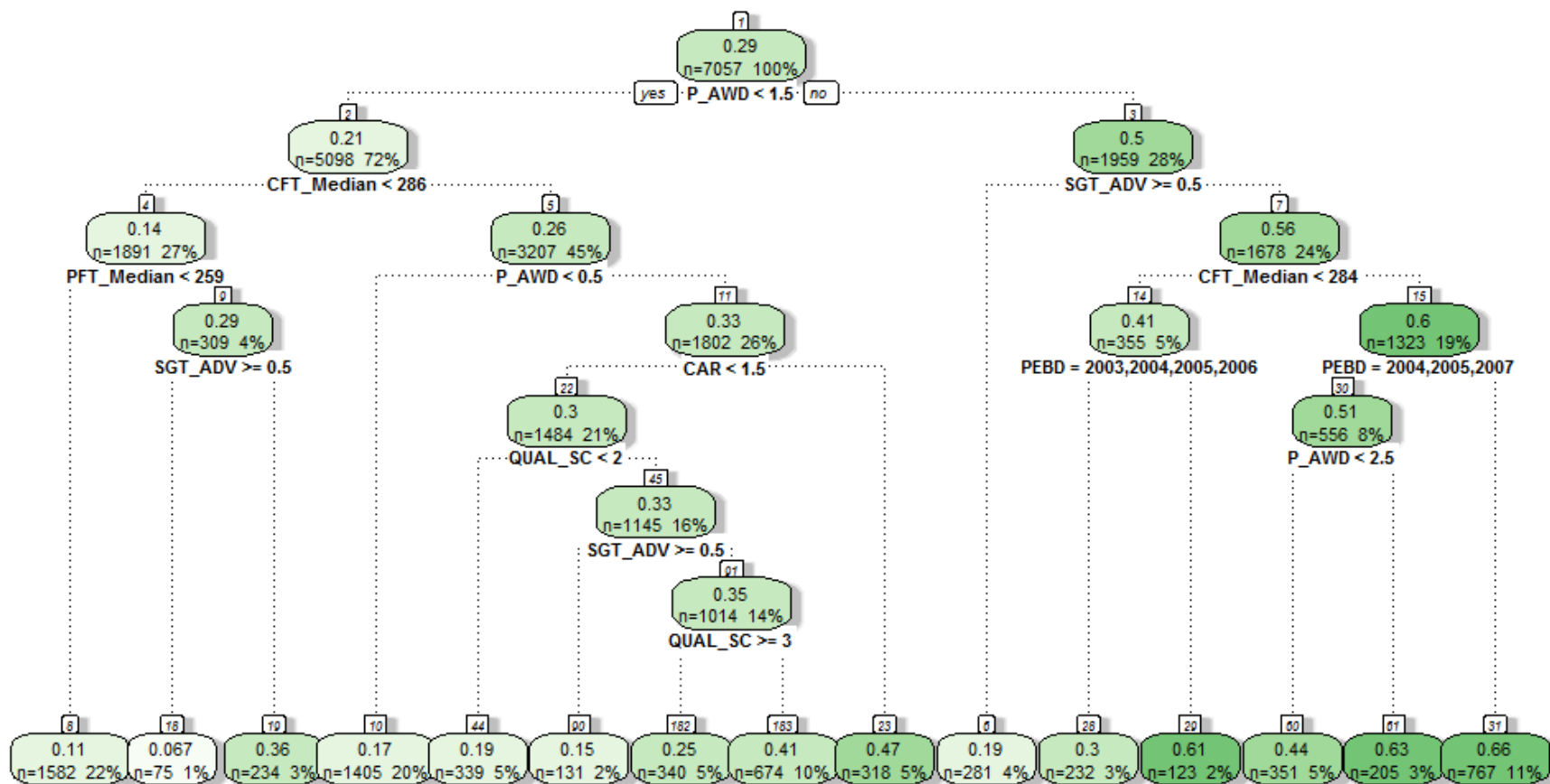


Figure 39. CART for Sergeants without Performance Evaluation Predictors



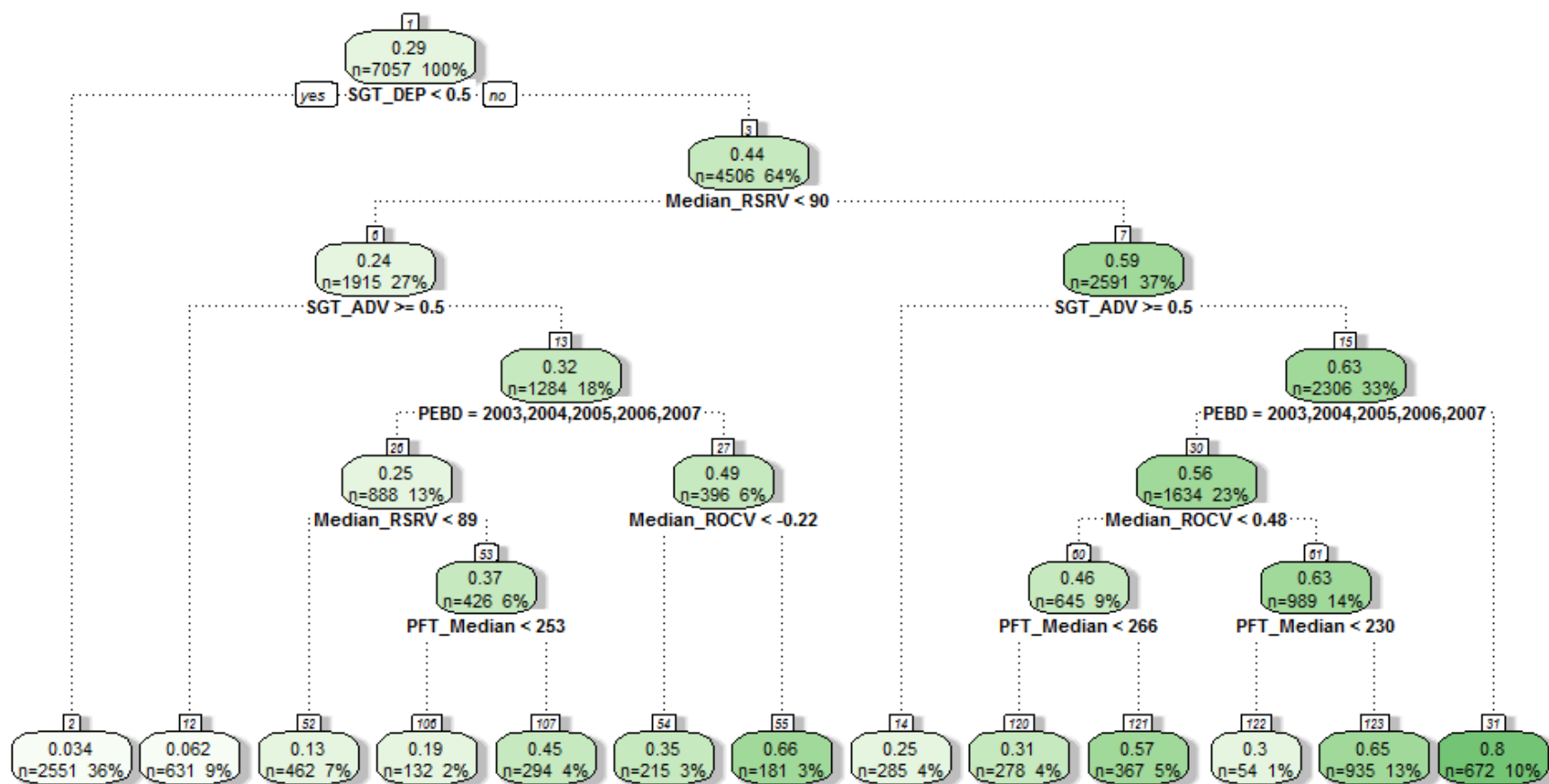


Figure 41. CART for Sergeants without CFT Predictors

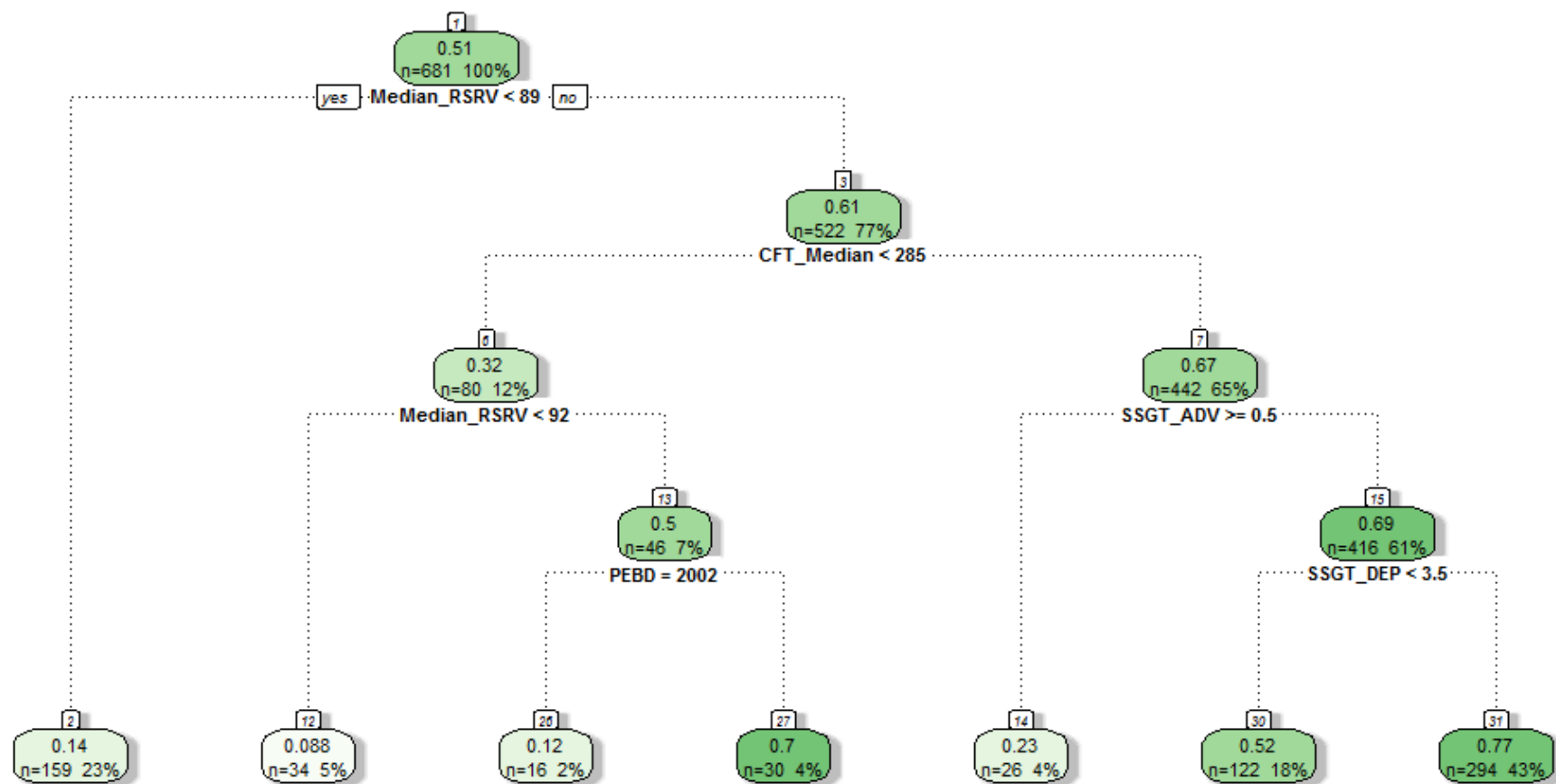


Figure 42. CART for Staff Sergeants with All Predictors

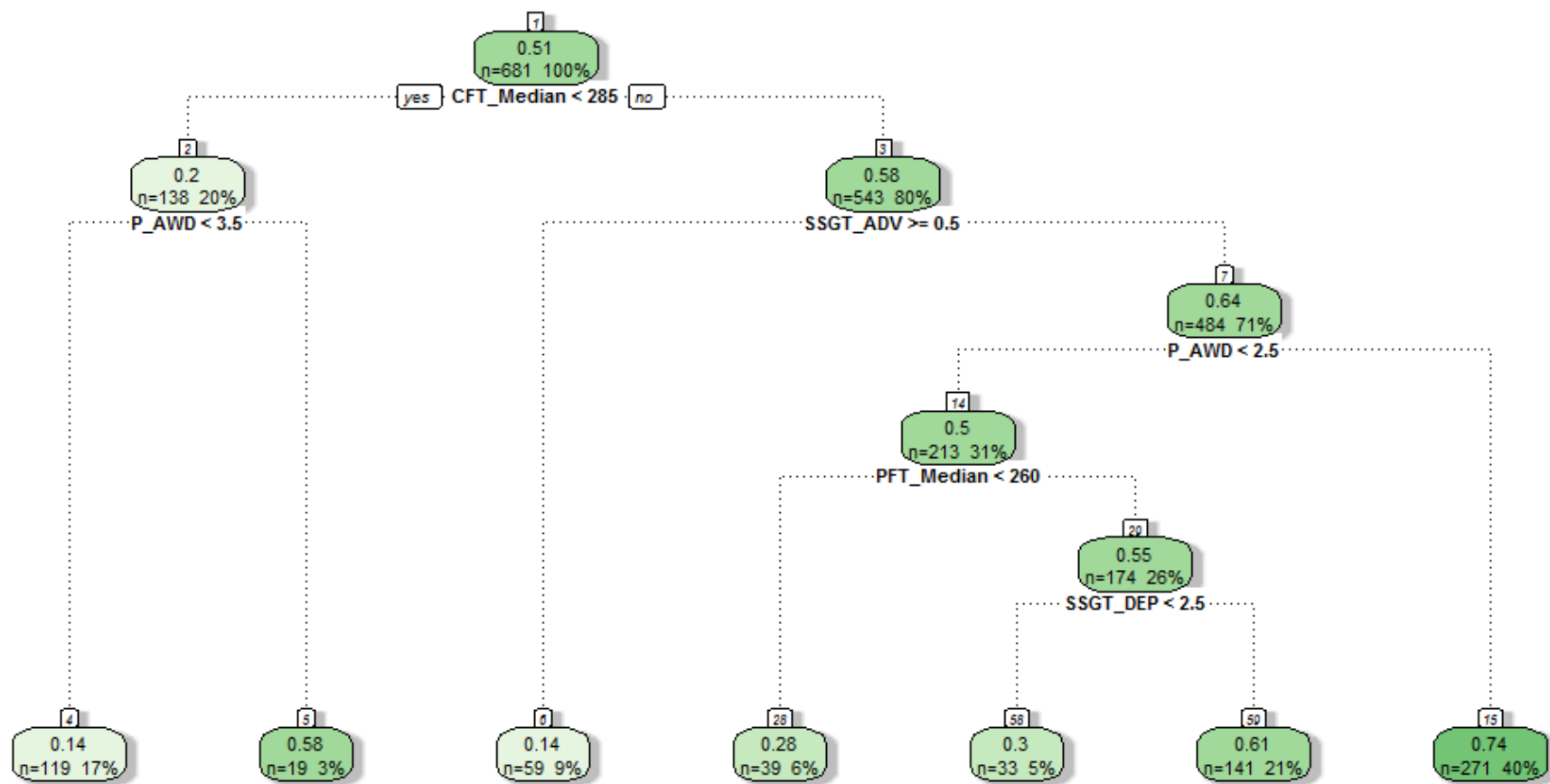


Figure 43. CART for Sergeants without Performance Evaluation Predictors

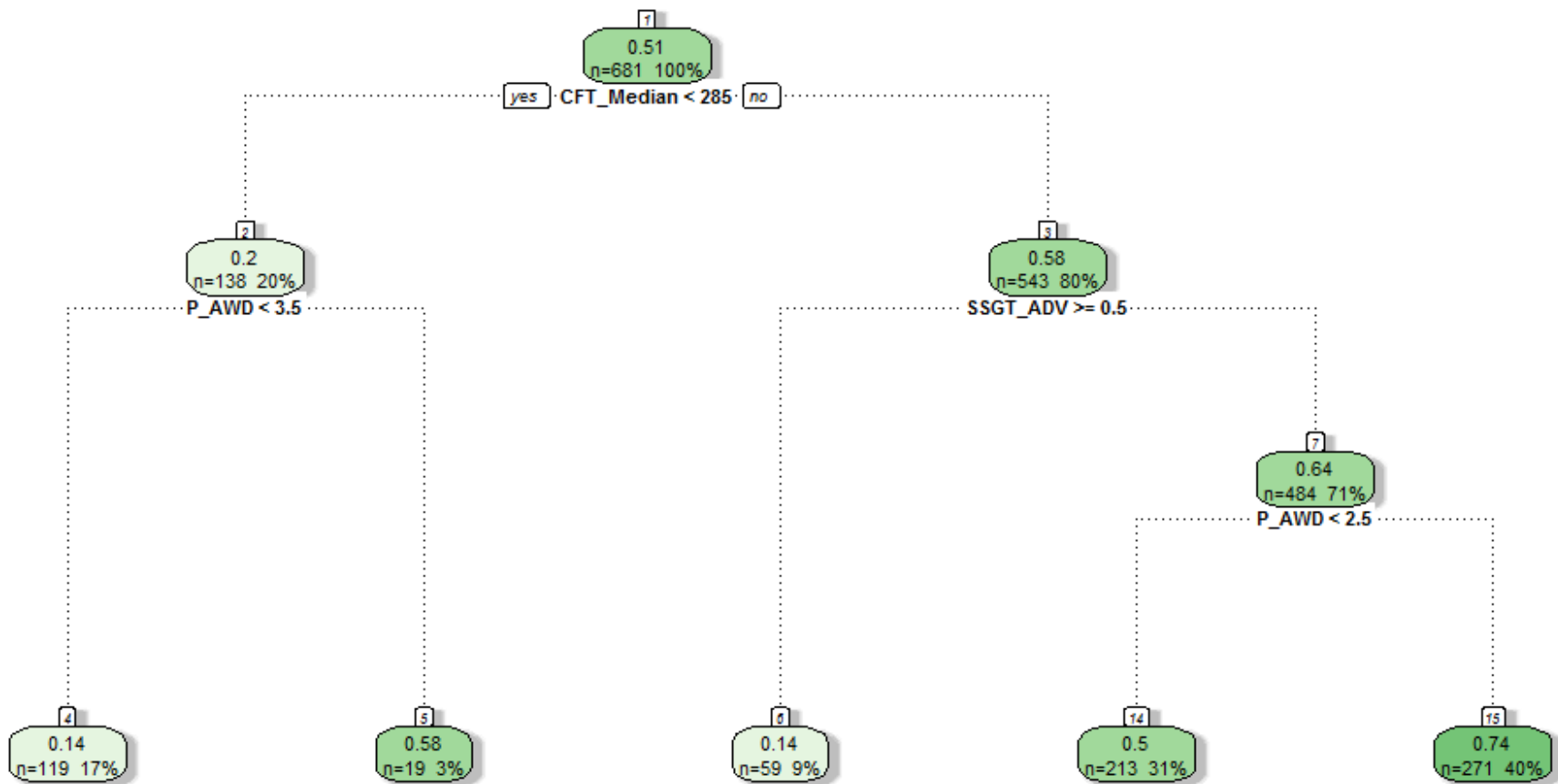
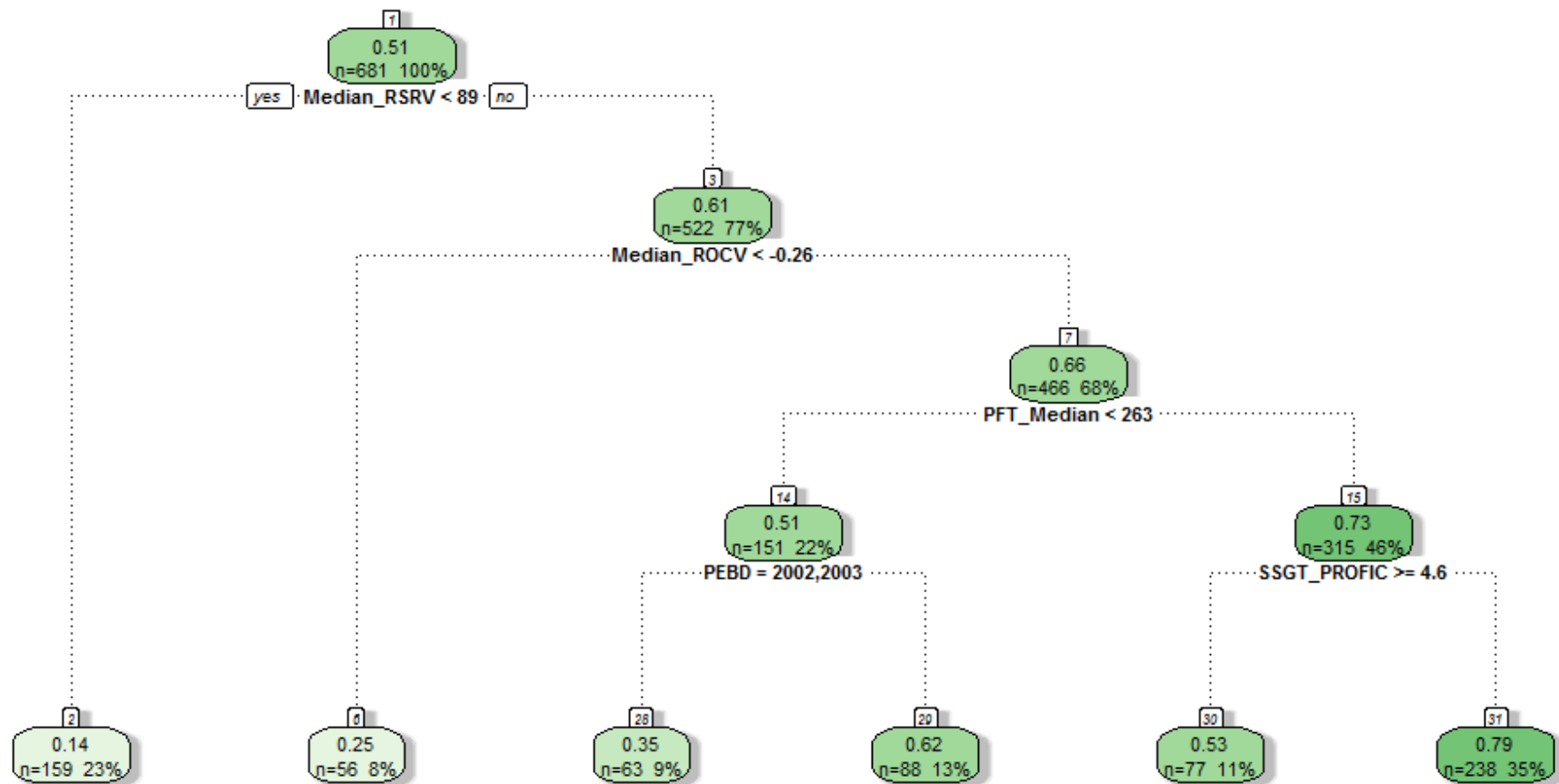


Figure 44. CART for Staff Sergeants without Performance Evaluation or Deployment Predictors



APPENDIX E. PROMOTION TABLES BY RANK

Table 20. Lance Corporal Proficiency and Conduct Range Proportions by PEBD Year

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2001)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2001)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.23	0.13	0.41	LOW	0.00 to 4.29	0.17	0.10	0.42
MID-LOW	4.29 to 4.35	0.32	0.32	0.73	MID-LOW	4.29 to 4.35	0.35	0.33	0.69
MID-HIGH	4.35 to 4.40	0.24	0.28	0.82	MID-HIGH	4.35 to 4.40	0.25	0.30	0.86
HIGH	4.40 to 5.00	0.21	0.27	0.91	HIGH	4.40 to 5.00	0.21	0.26	0.88

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2002)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2002)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.19	0.11	0.40	LOW	0.00 to 4.29	0.15	0.08	0.43
MID-LOW	4.29 to 4.35	0.30	0.28	0.70	MID-LOW	4.29 to 4.35	0.32	0.30	0.70
MID-HIGH	4.35 to 4.40	0.24	0.27	0.83	MID-HIGH	4.35 to 4.40	0.26	0.28	0.80
HIGH	4.40 to 5.00	0.27	0.34	0.92	HIGH	4.40 to 5.00	0.27	0.33	0.93

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2003)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2003)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.19	0.12	0.43	LOW	0.00 to 4.29	0.16	0.10	0.48
MID-LOW	4.29 to 4.35	0.33	0.34	0.70	MID-LOW	4.29 to 4.35	0.37	0.36	0.76
MID-HIGH	4.35 to 4.40	0.24	0.26	0.80	MID-HIGH	4.35 to 4.40	0.24	0.26	0.83
HIGH	4.40 to 5.00	0.24	0.28	0.93	HIGH	4.40 to 5.00	0.23	0.27	0.90

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2004)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2004)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.20	0.14	0.50	LOW	0.00 to 4.29	0.17	0.11	0.62
MID-LOW	4.29 to 4.35	0.36	0.36	0.75	MID-LOW	4.29 to 4.35	0.38	0.38	0.70
MID-HIGH	4.35 to 4.40	0.24	0.26	0.84	MID-HIGH	4.35 to 4.40	0.24	0.26	0.84
HIGH	4.40 to 5.00	0.20	0.24	0.91	HIGH	4.40 to 5.00	0.21	0.25	0.87

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2005)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2005)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.20	0.12	0.40	LOW	0.00 to 4.29	0.18	0.12	0.42
MID-LOW	4.29 to 4.35	0.39	0.39	0.64	MID-LOW	4.29 to 4.35	0.40	0.39	0.62
MID-HIGH	4.35 to 4.40	0.23	0.25	0.70	MID-HIGH	4.35 to 4.40	0.25	0.27	0.71
HIGH	4.40 to 5.00	0.18	0.24	0.85	HIGH	4.40 to 5.00	0.17	0.22	0.83

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2006)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2006)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.22	0.12	0.39	LOW	0.00 to 4.29	0.18	0.10	0.31
MID-LOW	4.29 to 4.35	0.37	0.35	0.56	MID-LOW	4.29 to 4.35	0.41	0.39	0.56
MID-HIGH	4.35 to 4.40	0.24	0.28	0.72	MID-HIGH	4.35 to 4.40	0.24	0.27	0.68
HIGH	4.40 to 5.00	0.17	0.25	0.86	HIGH	4.40 to 5.00	0.17	0.24	0.83

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2007)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2007)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.23	0.14	0.37	LOW	0.00 to 4.29	0.19	0.12	0.37
MID-LOW	4.29 to 4.35	0.37	0.36	0.58	MID-LOW	4.29 to 4.35	0.25	0.31	0.59
MID-HIGH	4.35 to 4.40	0.25	0.29	0.70	MID-HIGH	4.35 to 4.40	0.41	0.27	0.65
HIGH	4.40 to 5.00	0.15	0.20	0.80	HIGH	4.40 to 5.00	0.15	0.20	0.81

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2008)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2008)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.23	0.14	0.40	LOW	0.00 to 4.29	0.21	0.13	0.40
MID-LOW	4.29 to 4.35	0.42	0.41	0.62	MID-LOW	4.29 to 4.35	0.43	0.41	0.61
MID-HIGH	4.35 to 4.40	0.20	0.25	0.77	MID-HIGH	4.35 to 4.40	0.22	0.26	0.76
HIGH	4.40 to 5.00	0.14	0.20	0.90	HIGH	4.40 to 5.00	0.14	0.19	0.86

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2009)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2009)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.25	0.16	0.39	LOW	0.00 to 4.29	0.26	0.17	0.40
MID-LOW	4.29 to 4.35	0.42	0.43	0.65	MID-LOW	4.29 to 4.35	0.43	0.44	0.65
MID-HIGH	4.35 to 4.40	0.20	0.24	0.77	MID-HIGH	4.35 to 4.40	0.20	0.24	0.73
HIGH	4.40 to 5.00	0.12	0.17	0.86	HIGH	4.40 to 5.00	0.11	0.15	0.84

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2010)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2010)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.24	0.17	0.54	LOW	0.00 to 4.29	0.22	0.15	0.52
MID-LOW	4.29 to 4.35	0.40	0.39	0.72	MID-LOW	4.29 to 4.35	0.43	0.43	0.74
MID-HIGH	4.35 to 4.40	0.22	0.27	0.90	MID-HIGH	4.35 to 4.40	0.21	0.25	0.87
HIGH	4.40 to 5.00	0.14	0.17	0.97	HIGH	4.40 to 5.00	0.14	0.17	0.89

Lance Corporal Conduct Range Quadrants and Probabilities of Promotion (2011)					Lance Corporal Proficiency Range Quadrants and Probabilities of Promotion (2011)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.22	0.17	0.58	LOW	0.00 to 4.29	0.18	0.15	0.60
MID-LOW	4.29 to 4.35	0.38	0.36	0.71	MID-LOW	4.29 to 4.35	0.42	0.41	0.73
MID-HIGH	4.35 to 4.40	0.23	0.26	0.84	MID-HIGH	4.35 to 4.40	0.23	0.25	0.79
HIGH	4.40 to 5.00	0.17	0.20	0.89	HIGH	4.40 to 5.00	0.17	0.19	0.89

Table 21. Corporal Proficiency and Conduct Range Proportions by PEBD Year

Corporal Conduct Range Quadrants and Probabilities of Promotion (2001)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2001)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.18	0.12	0.24	LOW	0.00 to 4.29	0.16	0.10	0.24
MID-LOW	4.29 to 4.35	0.33	0.27	0.30	MID-LOW	4.29 to 4.35	0.35	0.25	0.26
MID-HIGH	4.35 to 4.40	0.32	0.36	0.41	MID-HIGH	4.35 to 4.40	0.33	0.30	0.44
HIGH	4.40 to 5.00	0.16	0.26	0.59	HIGH	4.40 to 5.00	0.17	0.25	0.55

Corporal Conduct Range Quadrants and Probabilities of Promotion (2002)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2002)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.16	0.09	0.22	LOW	0.00 to 4.29	0.14	0.08	0.21
MID-LOW	4.29 to 4.35	0.32	0.24	0.29	MID-LOW	4.29 to 4.35	0.33	0.26	0.30
MID-HIGH	4.35 to 4.40	0.34	0.37	0.42	MID-HIGH	4.35 to 4.40	0.35	0.38	0.42
HIGH	4.40 to 5.00	0.18	0.30	0.64	HIGH	4.40 to 5.00	0.17	0.28	0.64

Corporal Conduct Range Quadrants and Probabilities of Promotion (2003)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2003)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.20	0.11	0.25	LOW	0.00 to 4.29	0.17	0.09	0.24
MID-LOW	4.29 to 4.35	0.34	0.31	0.41	MID-LOW	4.29 to 4.35	0.36	0.31	0.40
MID-HIGH	4.35 to 4.40	0.32	0.37	0.53	MID-HIGH	4.35 to 4.40	0.33	0.39	0.55
HIGH	4.40 to 5.00	0.14	0.21	0.71	HIGH	4.40 to 5.00	0.14	0.21	0.69

Corporal Conduct Range Quadrants and Probabilities of Promotion (2004)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2004)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.21	0.13	0.31	LOW	0.00 to 4.29	0.19	0.12	0.30
MID-LOW	4.29 to 4.35	0.37	0.33	0.43	MID-LOW	4.29 to 4.35	0.39	0.34	0.42
MID-HIGH	4.35 to 4.40	0.31	0.37	0.58	MID-HIGH	4.35 to 4.40	0.32	0.38	0.57
HIGH	4.40 to 5.00	0.11	0.16	0.72	HIGH	4.40 to 5.00	0.10	0.16	0.77

Corporal Conduct Range Quadrants and Probabilities of Promotion (2005)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2005)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.21	0.15	0.29	LOW	0.00 to 4.29	0.19	0.14	0.29
MID-LOW	4.29 to 4.35	0.39	0.36	0.36	MID-LOW	4.29 to 4.35	0.41	0.39	0.37
MID-HIGH	4.35 to 4.40	0.30	0.36	0.47	MID-HIGH	4.35 to 4.40	0.29	0.33	0.45
HIGH	4.40 to 5.00	0.09	0.13	0.55	HIGH	4.40 to 5.00	0.10	0.14	0.54

Corporal Conduct Range Quadrants and Probabilities of Promotion (2006)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2006)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.21	0.14	0.22	LOW	0.00 to 4.29	0.19	0.12	0.19
MID-LOW	4.29 to 4.35	0.39	0.35	0.29	MID-LOW	4.29 to 4.35	0.40	0.36	0.29
MID-HIGH	4.35 to 4.40	0.29	0.34	0.38	MID-HIGH	4.35 to 4.40	0.29	0.36	0.39
HIGH	4.40 to 5.00	0.11	0.17	0.48	HIGH	4.40 to 5.00	0.12	0.16	0.43

Corporal Conduct Range Quadrants and Probabilities of Promotion (2007)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2007)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.22	0.14	0.17	LOW	0.00 to 4.29	0.21	0.12	0.16
MID-LOW	4.29 to 4.35	0.42	0.39	0.26	MID-LOW	4.29 to 4.35	0.42	0.40	0.26
MID-HIGH	4.35 to 4.40	0.28	0.37	0.37	MID-HIGH	4.35 to 4.40	0.28	0.36	0.36
HIGH	4.40 to 5.00	0.08	0.10	0.36	HIGH	4.40 to 5.00	0.09	0.12	0.36

Corporal Conduct Range Quadrants and Probabilities of Promotion (2008)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2008)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.29	0.18	0.18	LOW	0.00 to 4.29	0.27	0.17	0.19
MID-LOW	4.29 to 4.35	0.40	0.38	0.28	MID-LOW	4.29 to 4.35	0.42	0.38	0.26
MID-HIGH	4.35 to 4.40	0.23	0.31	0.40	MID-HIGH	4.35 to 4.40	0.24	0.32	0.39
HIGH	4.40 to 5.00	0.08	0.13	0.46	HIGH	4.40 to 5.00	0.07	0.13	0.52

Corporal Conduct Range Quadrants and Probabilities of Promotion (2009)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2009)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.23	0.13	0.18	LOW	0.00 to 4.29	0.22	0.13	0.18
MID-LOW	4.29 to 4.35	0.41	0.38	0.30	MID-LOW	4.29 to 4.35	0.41	0.37	0.29
MID-HIGH	4.35 to 4.40	0.28	0.35	0.41	MID-HIGH	4.35 to 4.40	0.29	0.36	0.40
HIGH	4.40 to 5.00	0.08	0.14	0.56	HIGH	4.40 to 5.00	0.08	0.14	0.57

Corporal Conduct Range Quadrants and Probabilities of Promotion (2010)					Corporal Proficiency Range Quadrants and Probabilities of Promotion (2010)				
Quadrant	Conduct Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Proficiency Range	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	0.00 to 4.29	0.10	0.07	0.41	LOW	0.00 to 4.29	0.07	0.03	0.28
MID-LOW	4.29 to 4.35	0.34	0.34	0.54	MID-LOW	4.29 to 4.35	0.34	0.32	0.51
MID-HIGH	4.35 to 4.40	0.35	0.34	0.53	MID-HIGH	4.35 to 4.40	0.38	0.40	0.57
HIGH	4.40 to 5.00	0.21	0.25	0.66	HIGH	4.40 to 5.00	0.21	0.25	0.65

Table 22. Sergeant Reporting Senior and Reviewing Officer Value Proportions by PEBD Year

Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2001)					Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2001)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 88.2	0.25	0.09	0.11	LOW	-5.0 to -.45	0.25	0.09	0.13
MID-LOW	88.20 to 90.55	0.25	0.22	0.34	MID-LOW	-.45 to .1	0.25	0.23	0.35
MID-HIGH	90.55 to 92.8	0.25	0.35	0.47	MID-HIGH	.1 to .66	0.25	0.31	0.47
HIGH	92.80 to 100	0.25	0.33	0.60	HIGH	.66 to 5.0	0.25	0.37	0.57

Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2002)					Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2002)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 88	0.25	0.07	0.09	LOW	-5.0 to -.45	0.25	0.07	0.09
MID-LOW	88.00 to 90.55	0.25	0.23	0.28	MID-LOW	-.45 to .1	0.25	0.24	0.29
MID-HIGH	90.55 to 93	0.25	0.32	0.39	MID-HIGH	.1 to .629	0.25	0.32	0.40
HIGH	93.00 to 100	0.25	0.38	0.46	HIGH	.629 to 5.0	0.25	0.37	0.46

Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2003)					Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2003)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 88.34	0.25	0.04	0.04	LOW	-5.0 to -.42	0.25	0.06	0.06
MID-LOW	88.34 to 90.65	0.25	0.22	0.22	MID-LOW	-.42 to .14	0.25	0.21	0.21
MID-HIGH	90.65 to 93.05	0.25	0.35	0.35	MID-HIGH	.14 to .7	0.25	0.31	0.31
HIGH	93.05 to 100	0.25	0.39	0.39	HIGH	.7 to 5.0	0.25	0.42	0.42

Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2004)					Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2004)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 88.09	0.25	0.03	0.03	LOW	-5.0 to -.462	0.25	0.05	0.04
MID-LOW	88.09 to 90.4	0.25	0.19	0.17	MID-LOW	-.462 to .128	0.25	0.19	0.17
MID-HIGH	90.40 to 92.75	0.25	0.34	0.30	MID-HIGH	.128 to .7	0.25	0.33	0.30
HIGH	92.75 to 100	0.25	0.44	0.39	HIGH	.7 to 5.0	0.25	0.43	0.38

Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2005)					Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2005)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 89	0.25	0.08	0.10	LOW	-5.0 to -.26	0.25	0.07	0.09
MID-LOW	89.00 to 91	0.25	0.23	0.30	MID-LOW	-.26 to .25	0.25	0.23	0.30
MID-HIGH	91.00 to 93.4	0.25	0.30	0.39	MID-HIGH	.25 to .75	0.25	0.31	0.40
HIGH	93.40 to 100	0.25	0.39	0.50	HIGH	.75 to 5.0	0.25	0.39	0.50

Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2006)					Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2006)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 89.3	0.25	0.09	0.14	LOW	-5.0 to -.26	0.25	0.09	0.14
MID-LOW	89.30 to 91.55	0.25	0.23	0.37	MID-LOW	-.26 to .36	0.25	0.24	0.38
MID-HIGH	91.55 to 94.15	0.25	0.30	0.48	MID-HIGH	.36 to .87	0.25	0.31	0.50
HIGH	94.15 to 100	0.25	0.38	0.60	HIGH	.87 to 5.0	0.25	0.36	0.58

Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2007)					Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2007)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)	Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 88.35	0.25	0.06	0.08	LOW	-5.0 to -.414	0.25	0.07	0.08
MID-LOW	88.35 to 90.66	0.25	0.22	0.25	MID-LOW	-.414 to .16	0.25	0.22	0.26
MID-HIGH	90.66 to 93.05	0.25	0.33	0.38	MID-HIGH	.16 to .7	0.25	0.31	0.36
HIGH	93.05 to 100	0.25	0.39	0.45	HIGH	.7 to 5.0	0.25	0.40	0.46

Table 23. Staff Sergeant Reporting Senior and Reviewing Officer
Value Proportions by PEBD Year

Staff Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2001)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 88.80	0.25	0.08	0.16
MID-LOW	88.80 to 91.55	0.25	0.23	0.49
MID-HIGH	91.55 to 94.10	0.25	0.36	0.76
HIGH	94.10 to 100	0.25	0.33	0.7

Staff Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2001)				
Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	-5.0 to -.252	0.25	0.08	0.18
MID-LOW	-.252 to .29	0.25	0.24	0.51
MID-HIGH	.29 to .75	0.25	0.33	0.69
HIGH	.75 to 5.0	0.25	0.35	0.74

Staff Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2002)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 89.45	0.24	0.08	0.16
MID-LOW	89.45 to 92.10	0.26	0.22	0.4
MID-HIGH	92.10 to 94.60	0.26	0.35	0.65
HIGH	94.60 to 100	0.24	0.35	0.65

Staff Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2002)				
Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	-5.0 to -.155	0.25	0.08	0.16
MID-LOW	-.155 to .425	0.25	0.23	0.42
MID-HIGH	.425 to .85	0.25	0.31	0.57
HIGH	.85 to 5.0	0.25	0.38	0.71

Staff Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2003)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 90.20	0.25	0.13	0.27
MID-LOW	90.20 to 92.65	0.25	0.27	0.58
MID-HIGH	92.65 to 95.00	0.25	0.31	0.64
HIGH	95.00 to 100	0.25	0.29	0.61

Staff Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2003)				
Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	-5.0 to -.05	0.25	0.13	0.27
MID-LOW	-.05 to .45	0.25	0.27	0.58
MID-HIGH	.45 to .97	0.25	0.29	0.61
HIGH	.97 to 5.0	0.25	0.31	0.64

Staff Sergeant Reporting Senior Quadrants and Probabilities of Promotion (2004)				
Quadrant	Reporting Senior	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	00.00 to 90.51	0.25	0.05	0.09
MID-LOW	90.51 to 92.70	0.25	0.32	0.65
MID-HIGH	92.70 to 96.10	0.25	0.36	0.74
HIGH	96.10 to 100	0.25	0.27	0.56

Staff Sergeant Reviewing Officer Quadrants and Probabilities of Promotion (2004)				
Quadrant	Reviewing Officer	Proportion	P(Quadrant Prom)	P(Prom Quadrant)
LOW	-5.0 to -.17	0.25	0.09	0.18
MID-LOW	-.17 to .5	0.25	0.36	0.74
MID-HIGH	.5 to 1.0	0.25	0.27	0.56
HIGH	1.0 to 5.0	0.25	0.27	0.56

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