FRANKLIN UNIVERSITY PROFICIENCY EXAM (FUPE) STUDY GUIDE

Course Title:	***Probability and Statistics (MATH 380)***
Recommended Textbook(s):	*Probability and Statistics for Engineers and Scientists,* 6th edition, Walpole, Myers, Myers, Pearson Education, 1998
Number & Type of Questions:	16 multiple part problems
Permitted Materials:	**Programmable and/or graphic calculator, 8.5" x 5.5" student written note card.**
Time Limit:	None (At least 3 hours recommended)
Minimum Passing Score:	75% (300 points)

Description of the Test:

- Standard Normal Distribution, Student's T Distribution, F-Distribution and Chi-squared Distribution tables will be provided; however a calculator with built-in tables may be used instead.
- Although some problems on the test require a basic understanding of integral calculus, all of the problems requiring integration involve definite integrals and hence the integration may be done on a calculator.
- The student is expected to show enough work on problems that the grader can determine the method (calculator, had computation, table, etc.) that the student used to obtain the answer. Because some questions involve multiple steps, the grader will give credit for answers that show consistency and follow-through.
- Many questions have multiple parts. The student should attempt all parts of the question. No credit will be given for blanks! If the student shows a basic understanding of the concept, some credit can be given even if the computation is not correct.
- All probability values must be displayed correct to four decimal places. Statistics should be determined to two places further than the data set.
- The entire test must be taken in one sitting.
- Problems on the test are open-ended and similar to those in the exercises in the textbook. There are no single answer or multiple-choice questions.

Knowledge & Skills Required:

The following topics will form the basis of the FUPE exam.

Topic	Level of Mastery	Text Chapter[1]
Descriptive statistics, including mean, median, mode, range, quartiles, percentiles, outliers, extreme outliers	Compute values by hand (using a calculator but not the statistical functions of the calculator).	1
Descriptive statistical displays, including stem-and-leaf display, boxplot, time series plots, histogram	Complete required computations, construct and interpret display.	3
Frequency data	Compute mean, mode, variance, and percentiles.	3
Random variables and probability, including properties, dependency, complement, mutual exclusivity	Compute probabilities of an event; determine the correlation of two events; determine whether two events are independent; determine whether two events are mutually exclusive.	3
Continuous probability distribution	Determine the mean, variance and standard deviation of the distribution when given the probability density function.	3 and 6
Normal probability distribution	Determine probabilities associated with a normal distribution given mean and standard deviation of the distribution using either a calculator or table.	6
Normality plots	Use a normality plot to determine whether a function is normal.	6
Discrete probability distributions	Determine the mean, variance and standard deviation of the distribution when given the probability mass function. Verify that the distribution fits the properties of a probability distribution.	3 and 5
Binomial distribution	Calculate the probabilities associated with a situation illustrating a binomial distribution and determine the mean and variance of that probability distribution.	5
Poisson distribution	Calculate the probabilities associated with a situation illustrating a Poisson distribution and determine the mean and variance of that probability distribution.	5
	Describe the characteristics of a binomial and	5

[1] Walpole, Myers, Myers, *Probability and Statistics for Engineers and Scientists*, 6th edition, Pearson Education, 1998.

	Poisson distribution and whether a binomial or Poisson distribution is a better model for an application.	
Normal approximation to the binomial and Poisson distributions	Approximate probabilities for binomial and Poisson distributions with a normal distribution.	6
Correlation of two variables	Determine and interpret the correlation coefficient between two variables and determine whether the variables are independent.	11
Multiple random variables	Determine the mean and variance of a random variable that is a linear combination of random variables.	12
Central Limit Theorem	Explain what constitutes the "sampling distribution of means," describe the distribution, and determine its mean and variance. Define a random sample. State the CLT. Apply the CLT to a sampling distribution of means.	8
Terminology associated with inferential statistics, including sample, population, statistic, parameter, standard error of a statistic, estimated standard error, bias, mean square error, point estimate, interval estimate, hypothesis test, level of significance.	Use the proper terminology when discussing a solution.	8, 9, and 10
Hypothesis tests	Apply the logical reasoning underlying hypothesis testing. For each and every hypothesis testing situation: • Determine the parameter. • State the correct null and alternative hypotheses, using the correct symbols. • State the underlying assumptions or criteria for the particular test and the sampling assumptions (e. g., simple random sample). • Determine the probability density function that will be used to calculate the test statistic. • Determine the test statistic. • State the critical region and critical value(s) for the test. • Determine the p-value and interpret it.	10

	• Determine the decision in the test and state the reason for the decision. • Interpret the decision (conclusion).	
Type I and Type II error analysis	In a given hypothesis testing situation, determine what decision would constitute a Type I error and determine the consequences of that error and the probability of that error. In a given hypothesis testing situation, determine what decision would constitute a Type II error and determine the consequences of that error and the probability of that error. Explain how Type I and Type II errors are related. Determine how sample size affects the probability of a Type II error.	10
Confidence intervals	For the given parameter: • State the parameter. • State any assumptions or criteria for the interval. • Determine the interval. • Interpret the interval in terms of the situation.	9
Hypothesis tests and confidence intervals for: • mean with variance known • mean with variance unknown (large sample) • mean with variance unknown (small sample) • variance • proportion • difference of two means (dependent samples) • difference of two means (independent samples)	Conduct **each** of these hypotheses tests using the procedure outlined above. Construct a confidence interval for **each** parameter using the procedure above. Determine the size of a sample necessary for confidence interval. Determine probability of Type II error. Use student's t-distribution. Use chi-squared distribution. Determine sample size and the probability of a Type II error. Distinguish between a dependent and an independent situation and conduct the proper hypothesis test or construct the proper confidence interval. Distinguish between a dependent and an independent situation and conduct the proper hypothesis test or construct the proper confidence interval.	9 and 10

• difference of two proportions • ratio of two variances • difference of two or more means	Determine the appropriate sample size for the confidence interval. Use F-distribution) Use analysis of variance (ANOVA-one Way)	
Linear regression	Determine the independent and dependent variables. Define "residual" and interpret the properties of the residuals. Determine the linear regression equation and use the equation for predictions. Explain what is meant by "least squares regression." Interpret the Minitab output from a multiple regression analysis.	11
Design of experiments	Provide an overview of the strategy for experimentation.	1 and 3