**MATH 318 Final Exam**

**Name:**

This final exam is open book/open note. You may use a calculator, ruler, pencil, pen and graph paper. You may not use a cell phone calculator, computer, or any other electronic communication device.

Please read each question carefully; if you get stuck on a problem, leave it blank and move on to a later problem. Please answer all questions on these pages, show your work and give justifications for your answers.

1. Circle the most appropriate option and briefly describe how you made your selection.

a) Which is the best tool for calculating the probability of finding a parking space in downtown Bridgewater on Tusday afternoon? [5 pts]

Relative Frequency Classical Probability Subjective Probability

b) Which is the best tool for deciding whether to build a new middle school or put an addition on the high school? [5 pts]

Decision Analysis Linear Programming Contingency Table

c) Which is the best tool for deciding how many hours each of your franchises should remain open each day? [5 pts]

Decision Analysis Linear Programming Contingency Table

d) Which is the best tool for predicting the number of cars entering the science building parking lot between 1 and 2 PM on a weekday? [5 pts]

Binomial Theorem Poisson Distribution Exponential Distribution

e) Which is the best tool for deciding whether or not to play the lottery? [5 pts]

Decision Tree Utility Theory Objective Function Contingency Table

1. M-Mart’s records show that 20% of entering customers are male and 80% are female. Of their male customers, 75% make a purchase before leaving the store. Only 50% of female customers make a purchase before leaving the store.  
     
   a) Create a contingency table illustrating this data about M-Mart’s customers. [5 pts]  
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
   b) An M-Mart customer makes a purchase. What is the probability that that customer is female? [10 pts]
2. M-Mart is planning to expand its operations into Rhode Island. M-Mart’s president estimates that if this move is supported by the parent company, there is a 75% chance of a $5,000,000 increase income over the next 5 years and a 25% probability of a $2,000,000 decrease in income over the next 5 years. Without the support of the parent company the president estimates a 30% chance of a $5,000,000 increase and 70% chance of a $4,000,000 decrease in income.  
     
   a) Draw a decision tree to help M-Mart decide whether to expand. [10 pts]  
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
     
   b) Use the expected value approach to recommend a decision strategy for M-Mart. Show your calculations clearly. [10 pts]
3. (Inspired by problem 41, page 291.) Overdrive Oil Co. produces regular and premium gasoline. Regular gasoline has a profit contribution of $0.75 per gallon and premium gasoline has a profit contribution of $1.25 per gallon. Overdrive wishes to maximize profit contributions.  
     
   Overdrive’s management requires them to produce at least 10,000 gallons of regular gasoline. Their production capacity is 100,000 gallons. They have 60,000 gallons of grade B crude oil available; each gallon of regular gasoline requires .7 gallons of grade B crude and each gallon of premium requires .3 gallons of grade B crude. Overdrive wishes to produce at least as much premium as regular gasoline.  
     
   Overdrive plans to use linear programming to find optimal production amounts.  
     
   a) Define decision variables for Overdrive’s calculation. Include appropriate units. [5 pts]  
     
     
     
     
     
     
     
   b) Formulate a linear programming problem to help Overdrive solve their problem.  
   [10 pts]
4. (Inspired by problem 8 on page 612.) A dependency table for gymnasium construction is shown below with activity times listed in weeks.

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity** | **Description** | **Predecessor** | **Time to Complete** |
| A | Survey site | - | 6 |
| B | Develop design | A | 8 |
| C | Establish budget | A | 6 |
| D | Obtain financing | C | 12 |
| E | Hire contractor | B,C | 8 |
| F | Advertising | B | 5 |
| G | Construction | D,E | 10 |

a) Create and fill in a project network for this project. What is the earliest possible finish time? [10 pts]  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
b) Which tasks are critical? [5 pts]  
  
  
  
  
  
c) The planners aren’t certain how long it will take to obtain financing. They think it will take between 6 and 14 weeks, with a most probable time of 12 weeks. If this activity time is described by the beta probability distribution, what is the expected value of the time to obtain financing? [5 pts]

1. One six sided die is rolled 4 times. What is the probability that two of the rolls are 6’s?  
   [5 pts]

Bonus: Apply the minimax decision making strategy to M-Mart’s problem or explain why this strategy is inappropriate for use in this context. [5 pts]