Sample Exam C for Exam 3

Here's another sample exam, with solutions. As usual,change your View to DRAFT in the ribbon above. Then choose your answer and point to the red block containing it. I'll comment on your choice. A couple of problems (the decision tree and contingency table and matching) are done differently. I'll give you instructions when we get there. Note that this exam includes questions on queuing theory. That topic may not appear until Exam 4, depending on what semester you are taking 291.

Scott

COB 291 Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Exam III Section \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Test C Dr. Scott Stevens

The following exam consists of 14 multiple choice questions (1-14) and three partial credit problem (A, B, and C). You may, if you wish, use a 3 x 5 notecard as an aid on this exam.

Work carefully; be sure to answer the question posed. If any question seems unclear or ambiguous to you, raise your hand, and I will try to clarify it. As usual, your scantron answer will be taken as your actual answer for multiple choice questions.

You have 90 minutes to complete this test. Good luck.

Maintain 4 significant digit accuracy!

DO NOT TURN THIS PAGE UNTIL YOU ARE INSTRUCTED TO DO SO!!!

Point values of problems

|  |  |
| --- | --- |
| Problems 1 - 5 (Expected Values) | 4 points each |
| Problems 6-11 (Decision Trees) | 4 points each |
| Problem 12-14 (Contingency Tables) | 4 points each |
| Problem A (Queuing) | 16 points |
| Problem B (Contingency Tables)  Problem C (Decision Trees) | 15 points  13 points  100 points |

**Questions 1-4 refer to the situation below.**

US Motors makes four models of cars. To make this problem easy to visualize, we will imagine that all of these cars are currently parked in the US Motors “production lot”. The gasoline information for the four models is given in the table below, along with their names. The “% of production” column represents just what you’d think: 10% of all of the cars made by US Motors were Awesomes, and so on**. With the exception of question #2, all expected values are taken over all of the cars in the lot.** That is, we are referring to the expected value for a randomly selected car in the lot.

|  |  |  |  |
| --- | --- | --- | --- |
| Model | % of production | miles per gallon (**MPG**) | gas tank capacity  (**GAL**) |
| Awesome | 10 | 5 | 30 |
| Locust | 20 | 30 | 20 |
| Timber Wolf | 30 | 15 | 20 |
| Storm Crow | 40 | 20 | 20 |

1. Suppose we select a car at random from the lot. What is its expected gas tank capacity?

a) 20 gallons b) 21 gallons c) 22 gallons d) 22.5 gallons e) 25 gallons

1. Suppose we select a model at random from among the models which US Motors produces. What is the expected number of miles per gallon of that model?

a) 17.5 mpg b) 19 mpg c) 20 mpg d) 22.5 mpg e) 25 mpg

1. Suppose we wished to know the average range of a randomly selected car on the lot. (By definition, the range of a car is the distance it could travel on one tank of gas.) Let MPG be the number of miles per gallon of a randomly selected car on the lot. Let GAL be the gas tank capacity of a randomly selected car on the lot. Then the average range of a car on the lot
2. would be represented by E(MPG × GAL), but not by E(MPG) × E(GAL).
3. would be represented by E(MPG) × E(GAL), but not. E(MPG × GAL).
4. would be represented by both E(MPG) × E(GAL) and E(MPG × GAL).
5. would be represented by [E(MPG) × E(GAL)] - E(MPG × GAL).
6. would be represented by E(MPG × GAL) - [E(MPG) × E(GAL)].
7. Let **COST** be the sticker cost of a randomly selected car on the lot, and **TAGS** be the cost of taxes and tags for a randomly selected car on the lot. Suppose E(**COST) = $**10,500 and E(**TAGS**) = $500. For any car, assume its total cost is its sticker cost, plus the cost of its taxes and tags. Then
8. the expected total cost of a randomly selected car on the lot is certain to be $11,000.
9. the expected total cost of a randomly selected car on the lot is $11,000 if **COST** and **TAGS** are independent, but may be more if they are dependent.
10. the expected total cost of a randomly selected car on the lot is $11,000 if **COST** and **TAGS** are independent, but may be less if they are dependent.
11. the expected total cost of a randomly selected car on the lot is $11,000 if **COST** and **TAGS** are independent, but may be more or less if they are dependent.
12. the expected total cost cannot be computed from the given information, regardless of whether **COST** and **TAGS** are independent.
13. I take a six sided die and label its sides “-2”, “-1”, “0”, “1”, “2”, “3”. I then give this die to you, along with these instructions. “Decide now how many times you are going to roll it—you can roll it up to four times. Then go ahead and roll it that many times. I’ll write down the number that you roll each time. When you’re done, I’ll multiply all of those numbers together. Whatever the result of the multiplication is, I’ll pay you that many dollars. Obviously, if the result is negative, you pay me.” Your goal is to maximize your expected payoff from playing my game. How many times should you roll the die? [Hint: this is just another expected value problem! Think about expected value formulae!] Put mouse here for answer.

a) 0 times b) 1 time c) 2 times d) 3 times e) 4 times

Questions 6-10 refer to the decision theory problem below.

Here's a game called "Is It Even?” which is played with a deck of three cards labeled 1, 2, and 3, respectively. One of the cards is selected secretly and at random, and its value is noted by "the Reader". The number on this card is the payoff (in dollars) for the game, and your job is to guess the number on the selected card. If you succeed, you win the payoff amount, while if you guess incorrectly, you must pay the payoff amount to the Reader.

You may, if you wish, ask the reader one question about the selected number before making your guess--"Is it even?" You must pay $1 for an answer to this question, but the Reader must answer truthfully as to whether the selected number is even. [Note: if the Reader says that the card is even, you may assume that you will then guess "2" and win $2.] The decision tree for this problem, partially rolled back, appears below. **Note that, in this problem, we consider asking, “Is it even?” to be research. Change view to Print Layout to see the tree, then back to Draft.**



(questions on this problem appear on the following page)

6. The value indicated by the label **Answer #6** on the decision tree

a) is -2 b) is –1 c) is 0 d) is 2 e) cannot be determined without more probabilities.

1. The value indicated by the label **Answer #7** on the decision tree Put mouse here for answer.

a) is –2 b) is –4/3 c) is -1 d) is 0 e) is 3.

1. The optimal strategy for the decision tree shown is
2. always say “1”
3. always say “3”
4. ask “is it even?”
5. don’t ask, then guess “3”
6. none of these constitute the optimal strategy for this problem.
7. Asking “is it even?” constitutes research. The EVSI if this research is

a) $0 b) $1/3 c) $1 d) $4/3 e) none of these (a-d) is correct

1. The EVPI for this problem is simple to compute in your head. It is

a) $0 b) $1 c) $5/3 d) $2 e) $7/3

1. In a particular queuing system, P0 = 0.6, P1 = 0.2, P2 = 0.1, P3 = 0.1, and k = 3. Then Wq ­equals

a) 0 minutes b) 1/3 calling unit c) 1/3 minute d) ¼ calling unit e) ¼ minute

**Problem A. Matching**

**This questions concerns queuing theory, material which is not covered until the 4th exam in Summer 2012.**

Fill each blank preceding an entry in the left column with the letter of the single entry in the right column which best represents its meaning. No letter will be used more than once.

**Scenario:** Students working in the Showker computer lab. Assume that only one student can use a computer at any given time, that a student uses the computer until his or her work is complete, and that students who arrive when the lab is full will wait for the next available computer. Assume Poisson arrivals. Assume students are in the lab only to use the computers. We measure time in minutes. **(To see my answers, highlight the area below, then click on the FONT COLOR button on the toolbar (The A with the colored bar below it.)**

\_D\_\_ 

\_F\_\_ 1/

\_J\_\_ Pw

\_N\_\_ k

\_I\_\_ P0

\_E\_\_ Wq

\_G\_\_ W

\_A\_\_ LqA. The average number of students waiting for a computer.

1. The average number of students per minute that one computer can accommodate.
2. The average number of students in the lab.
3. The average number of students arriving at the lab per minute.
4. The average number of minutes a student waits to use a computer.
5. The average number of minutes that a student uses a computer.
6. The average number of minutes that a student spends in the lab.
7. The average number of minutes between successive student arrivals.
8. The fraction of the time that there are no students in the lab.
9. The fraction of the time that all computers are in use.
10. The fraction of the time that a given computer is in use.
11. The fraction of the time that no students are in the lab.
12. The fraction of the time that no one is waiting for a computer.
13. The number of computers in the lab.

Problem B and questions 12 - 14 are based on the situation below.

Tonight’s forecast is for cold weather, and you are concerned about your car starting in the morning, as your battery sometimes runs down. You haven’t checked it, but you estimate that there is a 10% chance that your battery is dead, a 15% chance that it is weak, and a 75% chance that it is fully charged. If your battery is strong, your car is 95% likely to start in the morning. With a weak battery, your chances of a successful start drop to 40%. If your battery is dead, of course, you have no chance of your car starting.

**Problem B:** Given this information, fill in the contingency tables shown below. The labels have been supplied for you. Study them carefully before you begin. The cell designators (a1, t1, etc.) are just names for the various boxes, and are used in questions 12 - 14. **(To see my answer in Word, drag your cursor to highlight the whole table, then click on the FONT COLOR button (The "A" with the colored bar under it) on the toolbar. If you’re in your browser but not in Word, you can do this same thing by highlighting the table, then choosing Format/Font/Font Color/Automatic on the menu bar.)**

**P(row and column) P(column | row)**

Starts Doesn’t Start Starts Doesn’t Start

Dead

Weak

Strong

Dead

Weak

Strong

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| a1 | 0 | | a2 | .1 | | t1  0.1 |
|  |  |
| a3 | .06 | | a4 | .09 | | t2  0.15 |
|  |  |
| a5 | .7125 | | a6 | .0375 | | t3  0.75 |
|  |  |
| t4 | .7725 |  | t5 | .2275 |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| b1 | 0 | | b2 | 1 | |  |
|  |  |  |
| b3 | .4 | | b4 | .6 | |  |
|  |  |  |
| b5 | .95 | | b6 | .05 | |  |
|  |  |  |
|  |  |  |  |  |  |  |

Dead

Weak

Strong

**P(row | column)**

Starts Doesn’t Start

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| c1 | 0 | | c2 | .4396 | |  |
|  |
| c3 | .07767 | | c4 | .3956 | |  |
|  |
| c5 | .9223 | | c6 | .1648 | |  |
|  |
|  |  |  |  |  |  |  |

Dead

Weak

Strong

12. We would like to determine the probability that car will start in the morning. This value will be cell

1. a5
2. t1
3. t4
4. b1 + b3 + b5
5. c1 + c3 + c5

13. Suppose the car starts in the morning. I’d like to know how likely it is that the battery was weak. The answer to this question cell

1. a3 b) b3 c) c3 d) t2 × t4 e) t4/t2

14. The contents of cell a3 tells us

1. how likely it is that the car will start if the battery is weak
2. how likely it is that the battery was weak in those cases in which the car starts
3. the probability that the battery turned out weak, but that the car started anyway
4. the expected value of the car starting with weak battery
5. the probability that either the car starts, or that the battery was weak, or both

**Problem C:**

A commuting JMU student has a 7:00 PM class on campus, and needs to find a parking space for her car. She has two possibilities for finding a parking place: G Lot, which always has available space, and H Lot, which often does not. Since her class is in Harrison, H Lot sounds more attractive to her. Of course, if she goes to H Lot and finds it filled, she must then drive to G Lot to park. The availability of parking in H Lot is related to whether there are any special events occurring at JMU that evening. Under normal circumstances, there is a 40% chance that parking is available in H Lot. When a special event is scheduled, however, this probability drops to 10%. Special events occur 20% of the time, and the student will know if a special event is scheduled before she drives to campus. Her goal is to arrive at class as early as possible. The time required for her various activities are listed below:

Walking to Class from Car Driving

Walking from G lot... 8 mins Driving from home to G lot... 25 mins

Walking from H lot... 1 min Driving from home to H lot... 27 mins

Driving from H lot to G lot... 3 mins

Draw the decision tree for this problem, including end-of-branch payoffs and chance branch probabilities. **You need not roll back the tree.** Change view to Print Layout to see the stuff below.

**To see my answer, click on the BORDER of this rectangle, then press the DELETE key on your keyboard.**

**(If some of the letters in this message disappear, you clicked INSIDE the rectangle. Try again.)**

Note: Problem 14.1, your first decision tree problem, also started with a chance node. We know the whether there is an event before driving to school, and hence before choosing our lot.

