**MGT 2251 Management Science**

**Review of Exam 3**

**Name (Print):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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Read each question carefully before you answer. Work at a steady pace, and you should have ample time to finish. **Good Luck!!!**

My signature *certifies* that I have taken this exam in accordance with the Georgia Tech honor Code.

## Signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Multiple Choice Questions (Q1- Q16) (2.5 points each)**

1. If probabilities of states of nature are available to the decision maker, then the decision-making environment is called
2. certain.
3. uncertain.
4. risky.
5. none of the above.
6. The earliest start time for an activity is equal to
7. the largest EF of the immediate predecessors.
8. the smallest EF of the immediate predecessors.
9. the largest ES of the immediate predecessors.
10. the smallest ES of the immediate predecessors.
11. The latest finish time for an activity is found during the backward pass through the network. The latest finish time is equal to
12. the largest LF of the activities for which it is an immediate predecessor.
13. the smallest LF of the activities for which it is an immediate predecessor.
14. the largest LS of the activities for which it is an immediate predecessor.
15. the smallest LS of the activities for which it is an immediate predecessor.
16. If a project is to be crashed at the minimum possible additional cost, then the first activity to be crashed must be
17. on the critical path.
18. the one with the shortest activity time.
19. the one with the longest activity time.
20. the one with the lowest cost.

**Answer questions from 5 to 11 using the information mentioned below:**

|  |  |  |  |
| --- | --- | --- | --- |
| Alternative \Outcomes | D | E | F |
| A | 30 | 10 | -10 |
| B | 15 | 10 | -5 |
| C | 0 | 0 | 0 |

A, B and C are alternatives (course of actions) and D, E and F are possible outcomes (states of nature). The values in the cells represent pay-offs for each combination of alternative and outcome are mentioned

1. What decision would an optimist make?

A) Alternative A

B) Alternative B

C) Alternative C

1. What decision would a pessimist make?

A) Alternative A

B) Alternative B

C) Alternative C

1. What decision should be made based on the minimax regret criterion?

A) Alternative A

B) Alternative B

C) Alternative C

1. Suppose the probabilities for states of nature D, E, and F are 0.3, 0.3, and 0.4, respectively. If a person selected Alternative A, what would the expected pay-off be?

A) 0

B) 10

C) 8

D) -10

1. Suppose the probabilities for states of nature D, E, and F are 0.3, 0.3, and 0.4, respectively. Which alternative should be chosen to maximize the expected pay-off?

A) Alternative A

B) Alternative B

C) Alternative C

1. If the probabilities for states of nature D, E, and F are 0.3, 0.3, and 0.4, respectively. What is expected opportunity loss of taking action B?

A) 15

B) 6.5

C) 0

D) -5

1. If the probabilities for states of nature D, E, and F are 0.3, 0.3, and 0.4, respectively and perfect information can be obtained. What is the value of perfect information?

A) 8

B) 6.5

C) 0

D) 4

1. What makes the difference between a good decision and a bad decision?

A) A good decision is based on logic.

B) A good decision considers all available data.

C) A good decision considers all alternatives.

D) All the above

1. A typical quantitative analysis or management science process includes: (I) Developing a solution; (II) Acquiring input data; (III) Communicating and implementing the results; (IV) Defining problem; (V) Developing a model; (VI) Testing the solution; (VII) Analyzing the results. Which of the following is the most appropriate sequence?
2. I, II, III, IV, V, VI, VII
3. IV, V, II, I, VI, VII, III
4. IV, II, III, I, V, VI, VII
5. II, VII, I, V, IV, VI, III
6. PERT

A) assumes that we do not know ahead of time what activities must be completed.

B) assumes that activity time estimates follow the normal probability distribution.

C) is a network technique that uses three time estimates for each activity in a project.

D) is a deterministic network technique that allows for project crashing.

E) None of the above

1. Which of the following is true about the expected value of perfect information?

A) It is the amount you would pay for any sample study.

B) It is calculated as EMV minus EOL.

C) It is calculated as expected value with perfect information minus maximum EMV.

D) It is the amount charged for marketing research.

E) None of the above

1. In decision making under \_\_\_\_\_\_\_\_, there are several possible outcomes for each alternative, and the decision maker does not know the probabilities of the various outcomes.

A) risk

B) utility

C) certainty

D) probability

E) uncertainty

**Problem Solving Questions**

Q1. Following table shows a set of activities, their relationship with each other and duration (number of days) for a project to build a bridge.

* 1. Draw a network diagram showing each activity of the project. (8 points)
  2. Compute ES, EF, LS, LF and slack for each activity. (10 points)
  3. Which activities are on critical path? (3 points)
  4. How long will it take to complete the project? (2 points)
  5. If the duration of activity E changes from 5 days to 7 days, how long will it take now to complete the project? (4 points)
  6. By how many days (from the time project begins) can we delay activity B without sacrificing on project completion date? (3 points)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Activity | Immediate predecessor | Duration | ES | EF | LS | LF | Slack |
| A | - | 6 |  |  |  |  |  |
| B | - | 5 |  |  |  |  |  |
| C | A | 8 |  |  |  |  |  |
| D | B,C | 4 |  |  |  |  |  |
| E | D | 5 |  |  |  |  |  |
| F | D | 6 |  |  |  |  |  |
| G | E,F | 4 |  |  |  |  |  |

Q2 ‘Atlanta Electronics’ specializes in manufacturing modern electronic components. It also builds the equipment that produces the components. Mark, who is responsible for advising the president of ‘Atlanta Electronics’ on electronic manufacturing equipment, has developed the following table concerning a proposed facility:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Profit ($) | | |
| Alternative \State of Nature | STRONG MARKET | FAIR MARKET | POOR MARKET |
| Large facility | 30 | 10 | -30 |
| Medium-sized facility | 15 | 5 | -20 |
| Small facility | 10 | 5 | -5 |
| No facility | 0 | 0 | 0 |

Suppose the probabilities of ‘Strong Market’, ‘Fair Market’ and ‘Poor Market’ are 0.2, 0.5 and 0.3. Answer the following questions:

1. Compute expected monetary value (EMV) for each alternative (5)
2. Based on EMV criteria, which alternative would you choose? (5)
3. What is expected value with perfect information (EVwPI)? (5)
4. If a marketing research firm gives you perfect information about the market, what is the maximum amount of money you are ready to pay to the research firm? (2)
5. Compute expected opportunity loss (EOL) for each alternative (8)
6. Based on EOL criteria, which alternative would you choose? (5)

**EMV criteria**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alternative \State of Nature | STRONG MARKET | FAIR MARKET | POOR MARKET | EMV |
| Large facility | 30 | 10 | -30 |  |
| Medium-sized facility | 15 | 5 | -20 |  |
| Small facility | 10 | 5 | -5 |  |
| No facility | 0 | 0 | 0 |  |
| Probabilities |  |  |  |  |
| **with perfect information** |  |  |  |  |

Based on EMV criteria, the best decision is:

Expected value with perfect information (EVwPI) =

EVPI=

**Expected Opportunity Loss (EOL) criteria**

**Opportunity Loss Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alternative \State of Nature | STRONG MARKET | FAIR MARKET | POOR MARKET | EOL |
| Large facility |  |  |  |  |
| Medium-sized facility |  |  |  |  |
| Small facility |  |  |  |  |
| No facility |  |  |  |  |
| Probabilities |  |  |  |  |

Q3 George Goleb is considering the purchase of two types of industrial robots. The Rob1 is a large robot capable of performing a variety of tasks, including welding and painting. The Rob2 is a smaller and slower robot, but it has all the capabilities of Rob1. The robots will be used to perform a variety of repair operations on large industrial equipment. Of course, George can always do nothing and not buy any robots. Thus, Rob 1, Rob 2 and “Do Nothing” are the three decision alternatives. The market for the repair operation could be either favorable or unfavorable. Thus, “Favorable Market” and Unfavorable market” are the two states of nature. George has constructed a payoff matrix showing the expected returns of each alternative and the probability of a favorable or unfavorable market. The data are presented:

|  |  |  |
| --- | --- | --- |
|  | **Favorable Market** | **Unfavorable** |
| **Probability** | **0.6** | **0.4** |
| Rob 1 | 50,000 | –40,000 |
| Rob 2 | 30,000 | –20,000 |
| Do Nothing | 0 | 0 |

George Goleb is considering the possibility of conducting a survey on the market potential for industrial equipment repair using robots. The cost of the survey is $5,000.

If George Golbe conducts the survey, with 0.62 probability the survey will give positive results. If the survey gives positive results:

* With 0.871 probability the market will be favorable
* With 0.129 probability the market will be unfavorable

If George Golbe conducts the survey, with 0.38 probability the survey will give negative results. If the survey gives positive results:

* With 0.158 probability the market will be favorable
* With 0.842 probability the market will be unfavorable

If George Golbe doesn’t conduct the survey, the probabilities of favorable and unfavorable markets are equal to the values given in the table above.

1. Draw the decision tree for the problem faced by Goleb. Make sure to include all the nodes for the decisions and states of nature, all the probabilities and all the payoffs in the decision tree.
2. Calculate the EMV at each state of nature node.
3. Based on the EMV values calculated, should George Golbe conduct the survey or not?