

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF STATISTICS AND OPERATIONS RESEARCH

SBA2202: DECISION AND RISK ANALYSIS

BSc. BUSINESS ANALYTICS: PART II

MARCH 2025 EXAMINATION

Time : 3 hours

Candidates should attempt **ALL** questions from Section A and **ANY THREE** questions from Section B. Each question should start on a fresh page.

SECTION A: Answer all questions in this section (40 marks).

- A1.** (a) What are the similarities between the Expected Monetary (EMV) approach and the Expected Opportunity Loss (EOL) approach? [2]
(b) Differentiate the utility functions approach from the EMV approach. [3]
(c) Give and outline an example of decision making under conflict. [4]

- A2.** A certain business manager projected the following profits as shown in the matrix below.

$$\begin{pmatrix} 8 & 1 & -10 \\ -2 & 6 & 12 \\ 16 & 0 & -26 \end{pmatrix}$$

What would be the best decision when the manager is 30% pessimistic and applied the following approaches to her problem:

- (a) The Laplace criterion. [2]
(b) The optimistic criterion. [1.5]
(c) The Hurwicz criterion. [3.5]

- (d) The maxmin criterion. [1.5]
 (e) The savage criterion. [3.5]

A3. A flower shop promises its customers delivery by 12noon on all flower orders made the previous day. All ordered flowers are processed the day an order is placed or the next day very early in the morning. The shop used its long history in the business to come up with the following probability distribution of the demand for roses for any particular day in February.

Table 1: Demand distribution of roses.

Dozens of roses	7	8	9	10
Probability	0.1	0.2	0.4	0.3

It costs the shop \$10 to process a dozen of roses and can sell each dozen for \$30. All unsold dozens of roses are either donated or thrown away depending on their condition. How many dozens of roses the shop should process for the Valentines day? [9]

- A4.** (a) Suppose there are three outcomes X, Y and Z after making a decision, then with the aid of diagram(s), state the continuity axiom. [4]
 (b) Consider the following game:

$$\begin{pmatrix} 3 & 0 \\ 4 & 3 \end{pmatrix}$$

- (i) Determine the optimal strategies of the players involved in the game problem. [4]
 (ii) Which player loses in the game problem? [2]

SECTION B: Answer any three questions in this section (60 marks).

- B5.** Last year's soya bean crop at Mlimisi Farm was lost because of a bacterial infection. Since then, extensive efforts have been made to eradicate the bacteria and the farm's manager now has to decide on whether to risk planting soya beans again this year or whether to plant maize which is less profitable. A consultant called in by the farm manager estimates (on the basis of preliminary evidence) that there is a 90% chance that the soil no longer has the bacteria. It is estimated that a successful soya bean crop would yield \$600,000 net profit while maize crop would yield \$500,000 on the same hectare. If the soil still has the bacteria then the sales from the soya bean crop would equate to the total cost of producing the crop.

The farm manager could ask a local laboratory to carry out a soil test before he decides on which crop to plant. This test normally costs \$100,000 for soil samples enough for his hectare. If the farm manager uses the test in making the decision then it has a 26% of indicating that the bacteria is still in the soil. There is 74% chance that the test indicates that the bacteria has been eradicated. If the test indicates that the soil still has the bacteria and the farm manager proceeds on planting soya beans then it is estimated that there would be 31% chances that the crop will be destroyed by the bacteria. However, if the farm manager decides to plant soya beans when the test indicates that the bacteria has been eradicated there would be 3% chances that the crop would be destroyed. Determine the best decision(s) the Umlimisi's farm manager should take. [20]

- B6.** (a) A certain car owner faces the decision on which deductible amount of comprehensive insurance coverage to choose. Comprehensive coverage includes losses due to fire, vehicle theft, vandalism and the forces of nature. The possible choices are zero deductible coverage for \$60 per year or \$50 deductible coverage for \$45 per year. *The owner pays the first \$50 of any loss of at least \$500.* Considering incidents covered by the comprehensive portion of the policy, the owner feels that the annual chances of more than one such incident will be at least \$50. Some of the owner's utility values are as given in Table 2.

Table 2: Car owner utility function

Amount (\$)	-95	-60	-50	-45	0
Utility	2.0	4.0	4.5	4.7	5.0

- (i) Construct the car owner's utility curve. [4]
 (ii) Hence, determine the owner's attitude towards risk. Justify your answer. [1,1]
- (b) Use the graphical method to obtain the optimal strategies of players in the following game problem.

$$\begin{pmatrix} -1 & 3 & -1 & 4 & 2 & -5 \\ -3 & 5 & 6 & 1 & 2 & 0 \end{pmatrix}$$

[14]

- B7. A farmer would like to decide among three crops he should grow this rain season. The profit from each crop is strongly dependent on the rainfall during the wet season. He categorised the amount of the rainfall as high, medium or low. He also estimated the potential profits in thousand of dollars from each crop as shown in Table 3

Table 3: Potential crop profits.

Rainfall	Maize	Sugar Beans	Potatoes
High	7.0	2.5	4.0
Medium	3.5	3.5	4.0
Low	1.0	4.0	3.0

Based on the weather in previous rain seasons and the current projection for this wet season, he estimated the chances of high rainfall as 20%, that of medium rainfall as 30% and that of low rainfall as 50%. Furthermore, services of a meteorological department could be employed at a cost of \$500 to provide a detailed survey of the current rainfall prospects. The survey result in three indicators for the rainfall namely weak indicator (I_1), average indicator (I_2) and strong indicator (I_3). The indicators can occur given the rainfall categories with the chances shown in Table 5.

Table 4: P(Indicator/Rainfall category)

Rainfall	I_1	I_2	I_3
High	70%	30%	10%
Medium	25%	60%	20%
Low	5%	10%	70%

Determine the optimal strategy the farmer should adopt this current rain season. [20]

- B8. Apply the simplex method to solve a game problem represented by the following matrix.

$$\begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$$

[20]

END OF QUESTION PAPER