EET 300.docx

# MACHAKOS UNIVERSITY

**University Examinations for 2022/2023 Academic Year**

**SCHOOL OF BUSINESS, ECONOMICS AND HOSPITALITY AND TOURISM MANAGEMENT**

**DEPARTMENT OF ECONOMICS**

**THIRD YEAR FIRST SEMESTER EXAMINATION FOR**

**BACHELOR OF ECONOMICS AND FINANCE**

**BACHELOR OF ECONOMICS AND STATISTICS**

**BACHELOR OF ECONOMICS**

**EES 302: OPERATIONS RESEARCH**

**DATE:** **TIME:**

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**INSTRUCTIONS**

**Answer Question One and Any Other Two Questions**

**QUESTION ONE (COMPULSORY) (30 MARKS)**

Answer the following questions:

a) "All models are wrong but they can be useful". Explain the phrase. Who coined the phrase? (5 marks)

b) Explain saddle point, Nash equilibrium and zero-sum game. (6 marks)

c) Explain the three components of a linear programming problem. (6 marks)

d) Explain the term basic feasible solution. (3 marks)

e) Solve the following problem graphically (10 marks)

Maximize $C = 12X_1 + 42X_2$

Subject to $X_1 + 2X_2 \geq 3$

$X_1 + 4X_2 \geq 4$

$3X_1 + X_2 \geq 3$

$X_1, X_2 \geq 0$

**QUESTION TWO (20 MARKS)**

(a) Given the following payoff table and probability distribution for $S_i$:

| **STATE** | **ACT** | | | |
|---|---|---|---|---|
| | $A_1$ | $A_2$ | $A_3$ | Probability |
| $S_1$ | 30 | 50 | -40 | $P(S_1) = 0.40$ |
| $S_2$ | 50 | 0 | 70 | $P(S_2) = 0.30$ |
| $S_3$ | -20 | 10 | 20 | $P(S_3) = 0.30$ |

i) Find the expected payoff of each act. (4 marks)

ii) What is the optimal act? (2 marks)

iii) What is the expected payoff under uncertainty (EMUU)? (4 marks)

iv) Determine the expected payoff under certainty (EMUC). (4 marks)

b) Linear programming solution is both a local and global optimum. Discuss. (6 marks)

**QUESTION THREE (20 MARKS)**

a) Two players, Row and Column, are driving toward each other on a one-lane road. Each player chooses simultaneously between going straight (S), swerving left (L), and swerving right (R). If one player goes straight while the other swerves, either right or left, the one who goes straight gets payoff 3 while the other gets –1. If each player swerves to his left, or each swerves to his right, then each gets 0 (remember, they are going in opposite directions). If both go straight, or if one swerves to his left while the other swerves to his right, then the cars crash and each gets payoff -4 (minus 4).

i) Write the payoff matrix for this game. (8 marks)

ii) Find all of the game's Nash equilibria in pure strategies. (4 marks)

iii) Find a Nash equilibrium in which Row uses a pure strategy and Column mixes between two of his strategies. Clearly identify which strategy or strategies have positive probabilities for each player, and what Column's mixing probabilities are. (Hint: Which of Row's pure strategies could make Column willing to put positive probability on two of Column's pure strategies?) (4 marks)

b) Explain the Bayes' Theorem. (4 marks)

**QUESTION FOUR (20 MARKS)**

a) Given the following information on an ICT assignment, answer the following questions below.

| TASK | DESCRIPTION | DURATION WORKING DAYS | PREDECESSOR |
|---|---|---|---|
| A | Requirement Analysis | 5 | - |
| B | Systems Design | 15 | A |
| C | Programming | 25 | B |
| D | Telecoms | 15 | B |
| E | Hardware Installations | 30 | B |
| F | Integration | 10 | C, D |
| G | Systems Testing | 10 | E, F |
| H | Training/Support | 5 | G |
| I | Hand-Over and Go-Live | 5 | H |

i) Determine the critical path of the assignment. (8 marks)

ii) Calculate the planned duration of the assignment in weeks. (3 marks)

iii) Identify any non-critical tasks and the float free slack on each. (3 marks)

b) Explain the two Duality Theorems. (6 marks)

**QUESTION FIVE (20 MARKS)**

Add appropriate dummy variables and solve the following linear programs by the simplex method:

Maximize $\pi = 6X_1 + 2X_2 + 5X_3$

Subject to 2 3 1 X1 10

$1 \quad 0 \quad 2 \qquad X2 \qquad \leq \quad 8$

$1 \quad 2 \quad 5 \qquad X3 \qquad \quad 19$

and $X_1, X_2 \geq 0$