



# MACHAKOS UNIVERSITY

University Examinations for 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT 410: KNOWLEDGE BASED SYSTEMS

DATE:

TIME:

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**INSTRUCTIONS:** Answer Question ONE and Any Other TWO Questions.

## QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define the following terms: (3 marks)
- Knowledge-based system
  - Knowledge
  - Expert systems
- b) Using an illustration, give the FIVE major components of a knowledge based system. (5 marks)
- c) Distinguish between the following knowledge types using examples:
- Priori knowledge and posteriori knowledge (2 marks)
  - Tacit knowledge and declarative knowledge (2 marks)
- d) Highlight THREE characteristics of intelligent agents as portrayed in knowledge based systems. (3 marks)
- e) Translate the following predicate logic statements into natural language statements. (5 marks)
- $\text{man}(\text{Ochieng})$
  - $\text{Kenyan}(\text{Ochieng})$
  - $\forall x (\text{Kenyan}(x) \rightarrow \text{African}(x))$
  - $\text{Governor}(\text{Alfred Mutua})$
  - $\forall x (\text{Citizen}(x) \rightarrow \text{loyalto}(x, \text{God}) \vee \neg \text{loyalto}(x, \text{God}))$
- ii.
- f) Represent the following statements in a semantic network. (5 marks)

- i) Tom is a cat.
  - ii) Tom caught a bird.
  - iii) Tom is owned by John.
  - iv) Tom is ginger in colour.
  - v) Cats like cream.
  - vi) The cat sat on the mat.
  - vii) A cat is a mammal.
  - viii) A bird is an animal.
  - ix) All mammals are animals.
  - x) Mammals have fur.
- g) Consider the following investment decision-making given in the following symbolic form:
- A=100,000 Shillings
  - B=Younger than 40 years of age
  - C= Education at University level
  - D= Annual income of at least 800,000 Shillings
  - E=Invest at Treasury bills
  - F=Invest at growth stocks
  - G=Invest at NSE

The rules are given as follows: -

- R1: IF A AND C THEN E
- R2: IF D AND C THEN F
- R3: IF B AND E THEN F
- R4: IF B THEN C
- R5: IF F THEN G

An investor has 100,000 Shillings and is younger than 40 years and wants an advice from an ES on whether to invest in NSE. Using backward chaining inference procedures advise the investor. (5 marks)

### QUESTION TWO (20 MARKS)

- a) Distinguish between an expert system and a conventional computer program. (8 marks)
- b) Expert systems have become an area of interest for major knowledge based systems in the world. Discuss FOUR advantages the society enjoys by adopting an expert system in a particular problem domain. (8 marks)
- c) The Bayes' theorem provides a statistical theory of evidence, which is used to update the probabilities attached to certain facts in the light of new evidence. Highlight TWO pros and TWO cons of the Bayesian method in handling uncertainty in knowledge based systems. (4 marks)

### QUESTION THREE (20 MARKS)

- a) Highlight FIVE sources of uncertainty in knowledge based systems. (5 marks)
- b) Draw a sample semantic network that includes the following objects: Jane, Machakos University, Ministry of Education, KUCCPS, Machakos County. (5 marks)
- c) Explain THREE reasons why predicate logic is preferred to propositional logic. (6 marks)

- d) A popular story goes that when the saying "The spirit is willing, but the flesh is weak" was translated by a computer into Russian and back into English, it was rendered as "The wine is good, but the meat is spoiled". Referencing this example describe any FOUR challenges faced to reasonably achieve Natural Language Processing. (4 marks)

**QUESTION FOUR (20 MARKS)**

- a) Differentiate between the following:
- (i) Deductive reasoning and inductive reasoning. (2 marks)
  - (ii) CASE based reasoning and human expert reasoning. (4 marks)
- b) AutoExpress Limited is an Automobile Selling Company. To improve customer service, the company is planning to reward customers who purchase a vehicle from them with basic vehicle diagnostic ability. The company plans to do this through a knowledge based system. You have been contracted to develop the system. Highlight EIGHT steps you will take to do so. (8 marks)
- c) Discuss the following approaches to approximate reasoning:
- i) Default reasoning (2 marks)
  - ii) Analogical reasoning (2 marks)
  - iii) Fuzzy logic (2 marks)

**QUESTION FIVE (20 MARKS)**

- a) Describe the following terms: (3 marks)
- i) Inferencing
  - ii) Uncertainty
  - iii) Reasoning
- b) Describe THREE type of Intelligence according to Howard Gardner's multiple intelligence theory. (6 marks)
- c) Describe THREE artificial intelligence application areas that portray knowledge based system. (6 marks)
- d) Explain FIVE methods used for knowledge elicitation (5 marks)