



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT 410 KNOWLEDGE BASED SYSTEMS

DATE: 22/10/2020

TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

- a) Given the following statements, prove their validity in Propositional Calculus using truth tables. (4 marks)
- $P \vee Q \Leftrightarrow Q \vee P$
 - $P \wedge (Q \vee R) \Leftrightarrow (P \wedge Q) \vee (P \wedge R)$
- b) Discuss the following forms of reasoning used in the design of expert systems
- Induction (2 marks)
 - Deduction (2 marks)
- c) Natural language is considered very expressive hence probably everything that can be expressed symbolically can be represented in natural language. Give THREE limitations of natural language as a language for knowledge representation. (3 marks)
- d) Outline THREE advantages that expert systems offer organisations (3 marks)
- e) Describe briefly THREE methods that could be applied to elicit the knowledge needed to solve a small problem. (6 marks)
- f) Identify and briefly explain the FOUR most common predicate functions (4 marks)
- g) Using ProLog write a program to display month and positions such that a user can query position to display a month or a month to display position (6 marks)

QUESTION TWO (20 MARKS)

- a) With the aid of appropriate diagram, explain FOUR major components of a Knowledge Based System. (8 marks)
- b) The whole process of developing knowledge-based systems is called knowledge engineering. Describe THREE main phases of designing a knowledge base system. (6 marks)
- c) Given the following knowledge set, represent the data using a semantic net. (6 marks)
- Tom is a cat.
Tom caught a bird.
Tom is owned by John.
Tom is ginger in colour.
Cats like cream.
The cat sat on the mat.
A cat is a mammal.
A bird is an animal.
All mammals are animals.

QUESTION THREE (20 MARKS)

- a) Write Visual Prolog program that represents the following natural language statements: (6 marks)
- i. George likes football.
ii. Nairobi is in Kenya.
iii. Andrews's address is 45633.
iv. Andrews Father is Daniel
- b) Describe the following approaches to approximate reasoning (6 marks)
- i. Fuzzy logic
ii. Default reasoning
iii. Analogical reasoning
- c) Consider the table below that shows the various characteristics of eggs laid by different birds. Devise a set of rules for identifying bird's eggs and show how you would cope with any ambiguity that arises. (8 marks)

Bird	Colour	Texture	Size
Blue bird	Brown	Speckled	Medium
Crow	Blue	Smooth	Small
Ostrich	Grey	Smooth	Medium
Swan	Grey	Smooth	Large
Guillemot	Brown	Speckled	Medium
Sparrow	Grey	Speckled	Small

QUESTION FOUR (20 MARKS)

- a) Discuss THREE strategies that may be used in determining the rule to fire from a conflict set during the execution of a production system. (6 marks)
- b) Briefly outline any FOUR areas of application of Expert System (4 marks)
- c)
 - i. Write a ProLog program that can be used to store information on vehicles. Vehicles can be classified as cars, trucks or 'other', depending on its features. The program should store information including Make, Odometer, Age, Color, and Price. (8 marks)
 - ii. Write Prolog statement to find a car that costs exactly Ksh 300,000 (2 marks)

QUESTION FIVE (20 MARKS)

- a) Explain THREE types of knowledge that can be used in knowledge based systems. (6 marks)
- b) Highlight FOUR methods of dealing with uncertain reasoning (4 marks)
- c) Consider the following investment decision-making scenario given in the following symbolic form:
 - A=200,000 Shillings
 - B=Younger than 35 years of age
 - C= Education at University level
 - D= Annual income of at least 1000,000 Shillings
 - E=Invest in Treasury bills
 - F=Invest in growth stocks
 - G=Invest at Nairobi Securities Exchange (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 Ksh. 200,000 and is younger than 35 years and wants an advice from an Expert System on whether to invest in NSE. Using backward chaining inference procedures advise the investor. (10 marks)