



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

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: 7/12/2021

TIME: 2:00 – 4:00 PM

INSTRUCTIONS: Attempt Question ONE and any other TWO questions.

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Using the truth table, review the following sentence in Propositional Logic and comment on its validity. (4 marks)

$$P \wedge (Q \vee R) \Leftrightarrow (P \wedge Q) \vee R$$

- b) Discuss the following forms of reasoning used in the design of expert systems
- i. Inductive reasoning (2 marks)
 - ii. Deductive reasoning (2 marks)
 - iii. Abductive reasoning. (2 marks)
- c) Translate the following sentences into first order logic (4 marks)
- i) There is a person who is loved by everybody.
 - ii) It is not true that everybody loves somebody
- d) Explain the differences between 'Procedural' and 'Declarative' knowledge, providing relevant examples to illustrate your answers. (6 marks)
- e) Consider the following medical expert system

% Medical expert system
symptom(cold, sneezing).
symptom(cold, running_nose).
symptom(flu, fatigue).
symptom(flu, cough).
symptom(flu, fever).
symptom(brain_tumour, headache).

Required:

- i) Devise a query that will pick the symptoms of flu (2 marks)
- ii) Add to the symptoms list two symptoms of TB and devise a query that can pick up both ailments. (You don't need to have the actual symptoms – you can make this up) (2 marks)
- iii) Add some rules that comprise of the medication that would be given for the ailments. (You don't need to have the actual medication – you can make this up) (2 marks)
- f) An education authority has a severe shortage of primary school teachers. It is proposed that an expert system should be built which can be used to teach English and Arithmetic to five year old children. Explain, giving reasons, why this scenario is (un)suitable for computerisation as expert system. (4 marks)

QUESTION TWO (20 MARKS)

- a) Briefly describe TWO issues that underline the need for intelligent agents in the modern society (4 marks)
- b) 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 vodka is good, but the meat is rotten*". Referencing this example discuss the challenges and difficulties a knowledge engineer would face when processing natural language in the development of intelligent knowledge-based systems. (8 marks)
- c) Represent the following as a set of frames: (8 marks)

The aorta is a particular kind of artery, which has a diameter of 2.5cm. An artery is a kind of blood vessel. An artery always has a muscular wall, and generally has a diameter of 0.4cm. A vein is a kind of blood vessel, but has a fibrous wall. Blood vessels all have tubular form and contain blood.

QUESTION THREE (20 MARKS)

- a) Identify and discuss THREE major characteristic differences between knowledge based systems (KBS) and conventional systems. (6 marks)
- b) Briefly discuss FOUR desirable features of a good knowledge representation scheme (8 marks)
- c) List and explain THREE knowledge elicitation methods a knowledge engineer would use during knowledge acquisition process (6 marks)

QUESTION FOUR (20 MARKS)

- a) Explain FOUR ways of handling imprecision and uncertainty in an expert system, clearly indicating the pros of each (8 marks)
- b) Discuss FOUR strategies that may be used in determining the rule to fire from a conflict set during the execution of a production system. (8 marks)
- c) Highlight, giving example, the place of humanoid robots in the COVID-19 era. (4 marks)

QUESTION FIVE (20 MARKS)

- a) With the aid of a diagram, describe the architecture of a typical knowledge based system. (6 marks)
- b) 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. (8 marks)

- c) List and explain any THREE application areas of Artificial Neural Networks (6 marks)