



"Investing in Africa's Future"

COLLEGE OF ENGINEERING AND APPLIED SCIENCES (CEAS)

NHAI105: EXPERT SYSTEMS AND SMART APPLICATIONS

END OF SECOND SEMESTER EXAMINATIONS

APRIL 2025

LECTURER: MR TIMOTHY MAKAMBWA

TIME: 3 HOURS

INSTRUCTIONS

You are required to answer questions as instructed in each section

Start each question on a new page in your answer booklet

Answer all questions in Section A and any three from Section B

Section A – (Compulsory 40 Marks)

Answer all questions in this Section

Question One

Knowledge can also be represented by symbols of logic. Logic is the study of rules of exact reasoning – inferring conclusions from premises. Automated reasoning – logic programming in the context of expert systems.

- a) Show that $P \rightarrow Q \equiv \neg P \vee Q$: by truth table [4]
- b) Show that $\neg(P \wedge Q)$ and $(\neg P) \vee (\neg Q)$ are logically equivalent, that is to say that $\neg(P \wedge Q) \equiv (\neg P) \vee (\neg Q)$ using the truth table or otherwise. [10]

Question Two

- a) In a rule-based system, the knowledge base contains the domain knowledge needed to solve problems coded in the form of rules. Identify and explain the main components of a rule-based system. [12]
 - b) Describe the three phases of designing an expert system. [6]
 - c) Describe four advantages that expert systems offer organisations that would otherwise have to employ human experts. [8]
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Section B (60 Marks)

Answer Any Three questions

Question Three

In a rule-based system, the inference engine determines which rule antecedents, if any, are satisfied by the facts. Two general methods of inferencing are commonly used as the problem-solving strategies of expert systems: **forward chaining and backward chaining**. Other methods used for more specific needs may include means-ends analysis, problem reduction, backtracking, plan generate- test, hierarchical planning and the least commitment principle, and constraint handling. Differentiate forward chaining and backward chaining under the following themes:

- I. Direction of reasoning
- II. Process
- III. Use case
- IV. Efficiency
- V. Example

[20]

Question Four

Business Intelligence (BI) systems include elements of both Executive Information Systems (EIS) and Decision Support Systems (DSS).

- a) Explain the key features of an EIS. **(7 marks)**
- b) Explain the key features of a DSS. **(7 marks)**
- c) Justify the claim that BI Systems incorporate elements of both EIS and DSS. Include a definition of a BI system within your answer. **(6 marks)**

Question Five

- a) Explain the main differences between a Decision Support System (DSS) and a Group Decision Support System (GDSS). **(10 marks)**
- b) Define an Expert System (ES). **(5 marks)**
- c) Define data mining and provide one example of its type. **(5 marks)**

Question Six

Attempt or answer any THREE

- a) Differentiate between star and snowflakes schema
- b) Explain Relational Online Analytical Processing (ROLAP) and Multidimensional Online Analytical Processing (MOLAP).
- c) Explain Architecture for online analytical mining.
- d) Explain benefits of Data warehousing.

(20 marks)

Question Seven

Machine Learning is a key focus in artificial intelligence (AI) and computational intelligence. Among the most important learning techniques are Fuzzy Logic, Artificial Neural Networks (ANNs), and Genetic Algorithms (GAs) and Genetically Evolved Network. Give an in-depth examination of these techniques

- a) Fuzzy Logic, **(5 marks)**
- b) Artificial Neural Networks (ANNs), **(5 marks)**
- c) Genetic Algorithms (GAs), **(5 marks)**
- d) Genetically Evolved Network. **(5 marks)**

END OF EXAMINATION