WOMEN'S UNIVERSITY IN AFRICA

Addressing gender disparity and fostering equity in University Education

FACULTY OF MANAGEMENT AND ENTREPRENEURIAL SCIENCES

BSc HONOURS DEGREE IN INFORMATION SYSTEMS

MAIN PAPER

IS314: ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

INTAKE 23: THIRD YEAR FIRST SEMESTER

TIME: 2 HOURS AFTERNOON

INSTRUCTIONS TO CANDIDATES

Answer any **four** questions.

Question 1

a) Explain the Total Turing test. [6]

b) For the following agents, determine its PEAS.

i. Automated cooker; [4]

ii. Traffic Control System [4]

c) Suggest distinguishing features for each of the following agent environment types;

i. Deterministic;

ii. Episodic; and

iii. Fully observable. [6]

d) With the aid of a diagram, describe how a reflex agent with states operates. [5]

Question 2

a) The fundamental goal of Knowledge Representation is to facilitate inferencing (conclusions) from knowledge. The issues that arise while using KR techniques are many. Identify any four issues and show how they affect knowledge representation. [4]

b) Discuss the limitations of semantic networks which can be addressed by using frames. [4]

c) Represent the following knowledge using a Semantic Network; [8]

Whale is a mammal	A reptile is an animal	Whales live in water
Mammals are animals	Bats have wings	Fish eat worms
Birds are animals	Bats are mammals	Fish lives in water
Fish are animals	Cats eat fish	Birds eat worms
Cats are mammals	Cats have fur	Birds have feathers

d) Study the following and answer the question that follow:

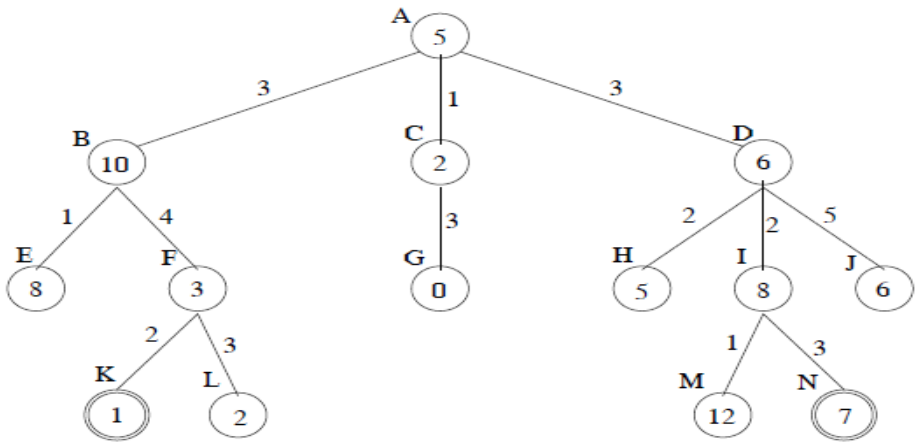
- Company: 1,050 employees, $130 million annual sales, Mary Sunny is the president
- Departments: accounting, finance, marketing, production, personnel
- Production department: five lines of production
- Product: computers
- Annual budget: $50,000 + $12,000 number of computers produced
- Materials: $6,000 per unit produced
- Working days: 250 per year
- Number of supervisors: one for every 12 employees

- Range of number of employees: 400-500 per shift (two shifts per day). Overtime or part-time on a third shift is possible.

Required: Prepare a set of frames for an organization with information specified above [9]

Question 3

Consider the following search tree. The tree has 14 nodes, two of which, K and N, are goals. The nodes of the tree are labelled with the heuristic value of those states i.e. the estimate of the distance from that node to the nearest goal. The arcs of the tree are labelled with the cost of taking the corresponding transitions in the problem.



a) Explain briefly whether you think the heuristic in the given search tree is admissible or not. [2]

b) Show how the Depth-First Search algorithm traverses this search tree until there are no more nodes left to search. [4]

c) Show how the Breadth-First Search algorithm traverses this tree until there are no more nodes left to search. [4]

d) Show how the greedy Best-First Search algorithm traverses this search tree until there are no more nodes left to search. [4]

e) Show how the A* search algorithm traverses this search tree until there are no more nodes left to search. [4]

f) Of the four search strategies above which is the best, argue your case. [5]

g) Breadth-first search is not guaranteed to find a solution if we apply it to a search space with infinite branching factor. Explain how breadth-first search could be modified to guarantee finding a solution even in a search space with infinite branching factor. [2]

Question 4

A local popular medical center asks you to design an expert system to help doctors diagnose a common recurring disease in the locality.

a) Discuss whether this might be a suitable problem for an expert system. [2]

b) Identify and evaluate any two sources of knowledge you would consider. [2]

c) Why is knowledge acquisition often referred to as the Expert System `bottleneck'? [5]

d) Discuss any two challenges associated with machine aided knowledge acquisition techniques. [4]

e) Why do many people say they will not trust a medical diagnosis expert system? [3]

f) State any six desirable features every Expert System is supposed to possess. [6]

g) Describe at least 3 advantages that expert systems offer organisations that would otherwise have to employ human experts. [3]

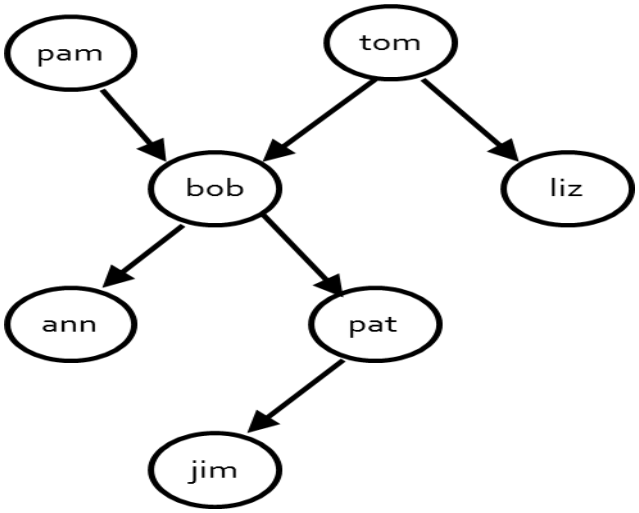
Question 5

a) Consider the following facts on Italian history:

i. Marcus was a man.
ii. Marcus was a Pompeian.
iii. All Pompeians were Roman.
iv. Caesar was a ruler.
v. All Romans were either loyal to Caesar or hated him.
vi. At some point, everyone disliked Caesar.
vii. Everyone is loyal to someone.
viii. Marcus tried to assassinate Caesar.
ix. People only try to assassinate rulers that they are not loyal to.
x. All Pompeian's died when volcano erupted in 79 AD

Required: Use predicate logic to represent the above facts. [10]

b) Pat and Tom have been married for 35 years and happen to be Bob's parents. Tom also has a child from his first marriage called Liz. Bob, also happen to have his own two children called Ann and Pat, who happen to be in their early 20's. Pat, Bob's oldest child has just fathered a son called Jim. The above information is represented in the family tree diagram below.



Required:

i. Write a PROLOG program to represent the above facts; [4]

ii. Write PROLOG queries to ask the following questions:

i. Who are Tom's children? [2]

ii. Do Ann and Pat have a common parent? [2]

iii. Who is the grand parent of Jim? [2]

c) Given the following production rules;

S→ X c

X →4Y X

Y→a | b

i. Describe the language described by these rules. [2]

ii. Derive the regular expression which defines the language represented. [3]

Question 6

a) Explain the major differences between an expert system and an agent system. Use real world examples to substantiate your answer. [9]

b) Explain any four approaches to Artificial Intelligence. [12]

c) List the four components or stages in problem solving. [4]

END