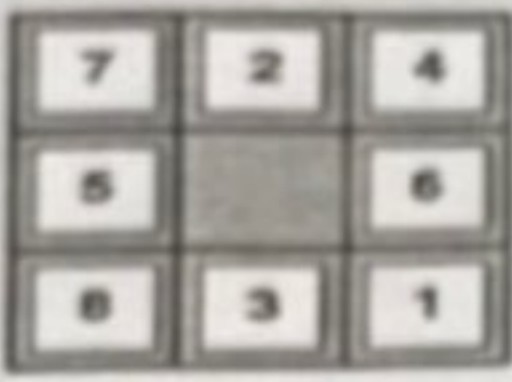
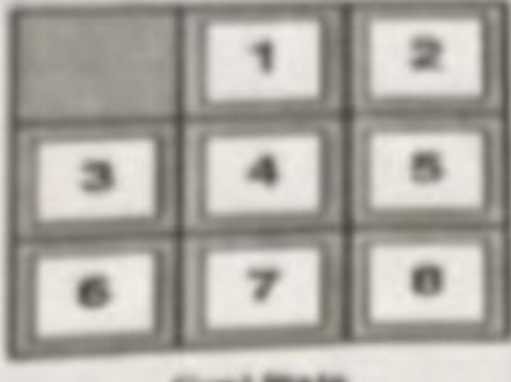
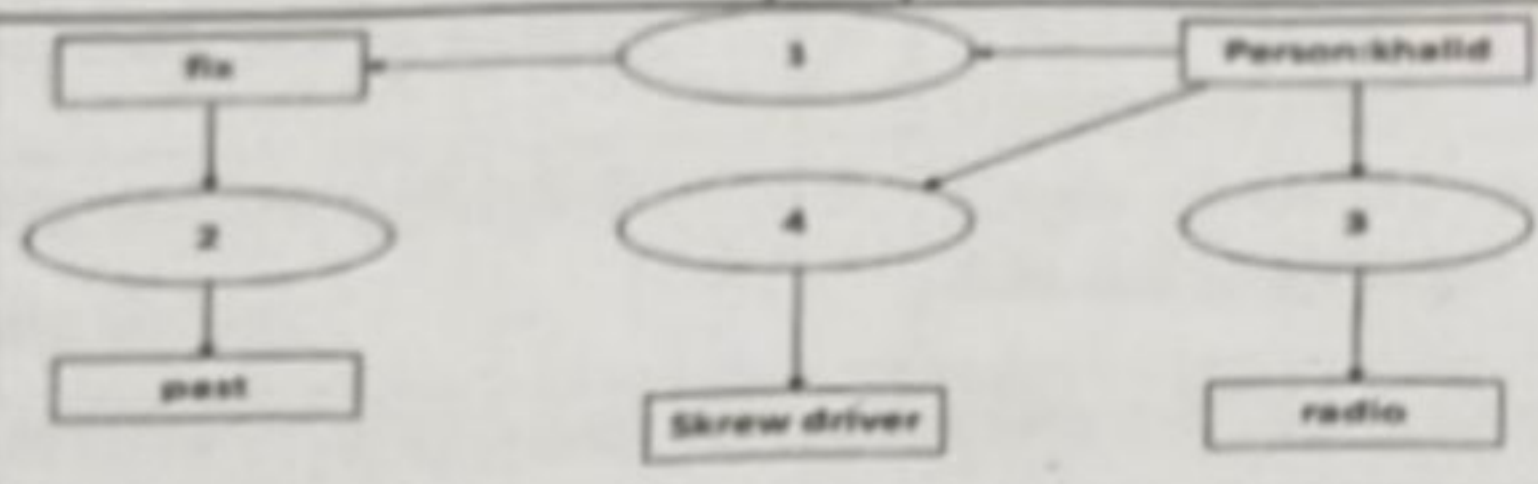


Part I: Choose the correct answer for each of the following questions and copy them to the table above.

Q1.	For the eight puzzle problem given, the $h(n)$ is number of tiles out of space. What is the value of $h(n)$ at the start state?	
	 Start State	 Goal State
a	6	b 5
c	8	d 7
Q2.use a heuristic to guide the search for the problem at hand and are efficient.	
a	Blind search	b Informed search
c	Uninformed search	d a and c
Q3.	Which one of the following identities is not true ...	
a	$\neg(P \vee Q) \equiv (\neg P \wedge \neg Q)$	b $P \wedge (Q \vee R) \equiv (P \wedge Q) \vee (P \wedge R)$
c	$(P \vee Q) \equiv (\neg P \rightarrow Q)$	d $\neg(P \wedge Q) \equiv (P \vee \neg Q)$
Q4.	"No student failed AI but at least one student failed DataBase."	
	Which of the following expresses the above sentence in predicate calculus	
a	$\neg \forall x (\text{Student}(x) \wedge \text{Failed}(x, \text{AI})) \wedge \exists x (\text{Student}(x) \wedge \text{Failed}(x, \text{DataBase}))$	b $\neg \exists x (\text{Student}(x) \vee \text{Failed}(x, \text{AI})) \wedge \exists x (\text{Student}(x) \wedge \text{Failed}(x, \text{DataBase}))$
c	$\neg \exists x (\text{Student}(x) \wedge \text{Failed}(x, \text{AI})) \vee \exists x (\text{Student}(x) \wedge \text{Failed}(\neg x, \text{DataBase}))$	d $\neg \exists x (\text{Student}(x) \wedge \text{Failed}(x, \text{AI})) \wedge \exists x (\text{Student}(x) \wedge \text{Failed}(x, \text{DataBase}))$
Q5.	Which of the following is not true	
a	$\neg \exists X p(X) \equiv \forall X \neg p(X)$	b $\neg \forall X p(X) \equiv \exists X \neg p(X)$
c	$\exists X p(X) \equiv \exists Y p(Y)$	d $\neg \forall X p(X) \equiv \exists X p(X)$
Q6.	$\forall X (\text{Girl}(X) \rightarrow \text{nice}(X)). \text{Girl}(\text{Saly}) .$	
	What is the conclusion of above predicates?	
a	Saly is not a girl	b Saly is not nice
c	Saly is nice	d a and c
Q7.	Which of the following is /are admissible algorithm(s)?	
a	Breadth first search	b A
c	A*	d a and c

Q8.	A fair six-sided die is tossed five times and the numbers up are recorded in a sequence. How many different sequences are there?			
a	6^5	b	$6!$	
c	$6!/5!$	d	$6^5/5!$	

Q9.	If $S = \{1,2,3,4,5,6,7,8,9,10\}$, and $A = \{6,8,10\}$, and $B = \{6,7,8,9,10\}$, then what will be the probability of Union of two sets of events: $P(A \cup B)$?			
a	$7/10$	b	$1/5$	
c	$3/10$	d	$1/2$	



What are the relations missing in the following diagram?

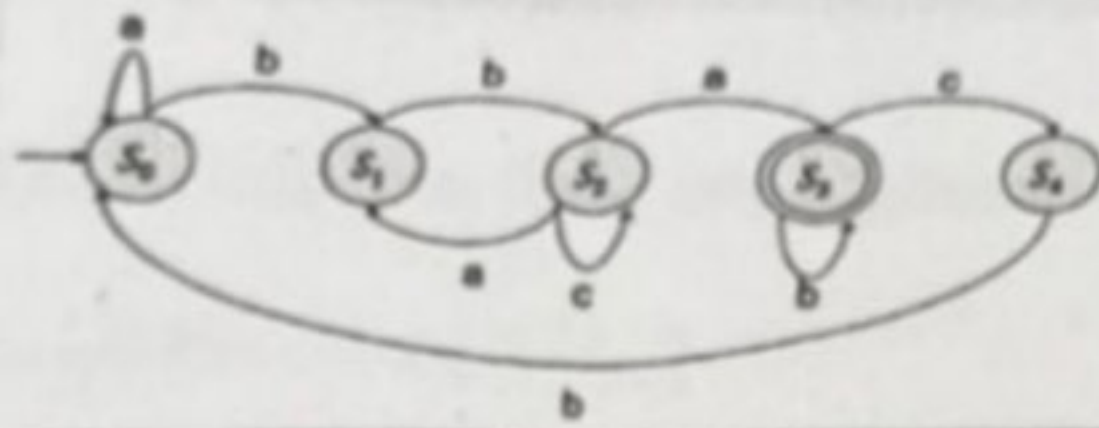
a	1-agent, 2-time, 3-instrument, 4-object	b	1-agent, 2-time, 3-object, 4-instrument
c	1-agent, 2-time, 3-receipient, 4-instrument	d	1-receipient, 2-time, 3-object, 4-instrument

Q11.	In unification, we can see the answer for "Unify $p(a, X)$ and $p(Y, f(Y))$ " to be ...			
a	a/Y	b	$a/Y, f(a)/X$	
c	$f(a)/X$	d	$a/X, f(a)/Y$	

Q12.	What is Artificial intelligence?			
a	A field that aims to make humans more intelligent	b	Programming with your own intelligence	
c	is the branch of computer science concerned with making computers behave like humans.	d	is the branch of computer science concerned with making humans behave like computers.	

Q13.	Which of the following is considered as an Intelligent behavior?			
	Learn from experience	b	Solve problems when all important information are available	
	Apply knowledge acquired from experience	d	a and c	

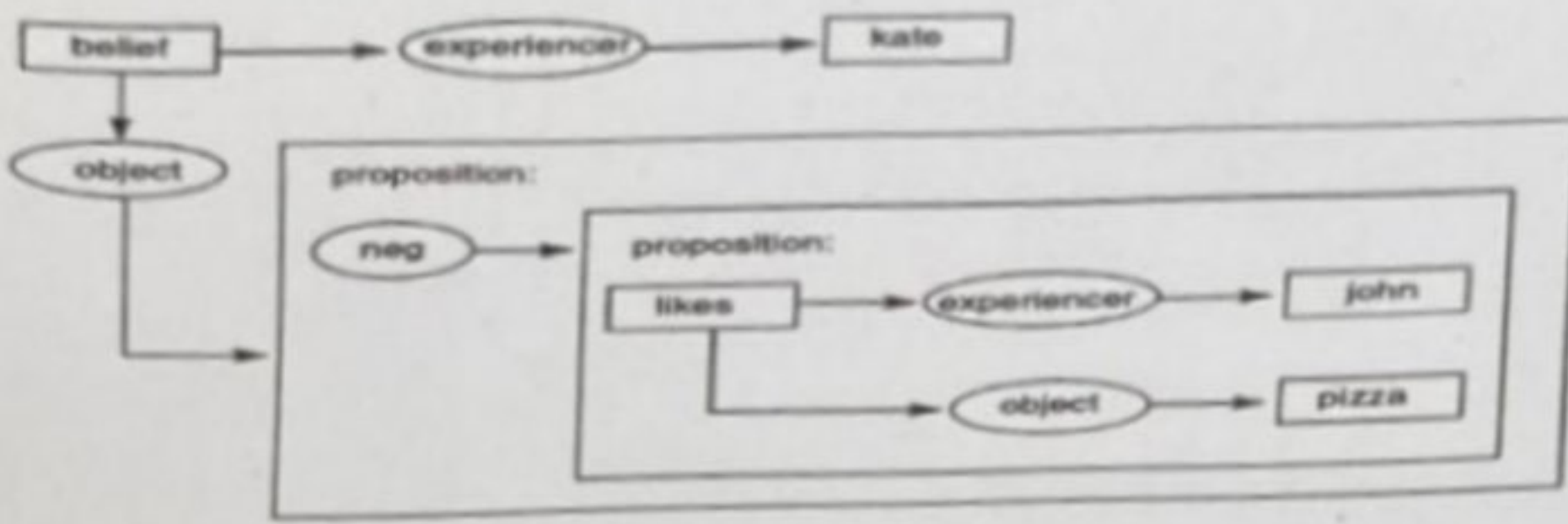
4. Given the FSM below that accepts a, b, and c as strings, which sequence of input is accepted by this machine?



a	abcabbca	b	abbccabcb
c	abbabcca	d	abbccabc
Q15.	An Artificial intelligence system can be divided into many components:		
a	hardware, software, data, and knowledge	b	Hardware, operating system, device drivers and Users.
c	Hardware, operating system, application programs and device drivers	d	people, procedures, hardware, software, data and knowledge
Q16. is a science of translating actual knowledge into a format that can be used by the computer.		
a	Expert systems	b	Machine learning
c	Genetic algorithms	d	Knowledge Representation
Q17.	In planning using STRIPS, the element of the triple that describes items that are removed from a state description to create the new state when the operator is applied is called?		
a	Pre-conditions	b	Add list
c	Delete list	d	Action
Q18.	Two events A and B are independent of each other if and only if:		
a	$P(A \cap B) = P(A)$	b	$P(A \cup B) = P(A) + P(B)$
c	$P(A \cup B) = P(B)$	d	$P(A \cap B) = P(A)P(B)$
Q19.	Because it always examines all the nodes at level n before proceeding to level n + 1, always finds the shortest path to a goal node.		
	Best first Greedy search	b	Hill climbing
	Depth first search	d	Breadth-first search
	The main drawback of hill-climbing search is.....		
	Terminates at local optimum.	b	Terminates at global optimum.
	Keeps every node in memory.	d	Fail to find a solution.

Part 2: Answer the following questions:

Q1. Translate the conceptual graph of the following figure into English sentence. (2 marks)



Q2. Consider the following Prolog program. (3 marks)

```

house_elf(dobby) .
witch(hermione) .
witch('McGonagall') .
witch(rita_skeeter) .
magic(X) :- house_elf(X) .
magic(X) :- wizard(X) .
magic(X) :- witch(X) .
  
```

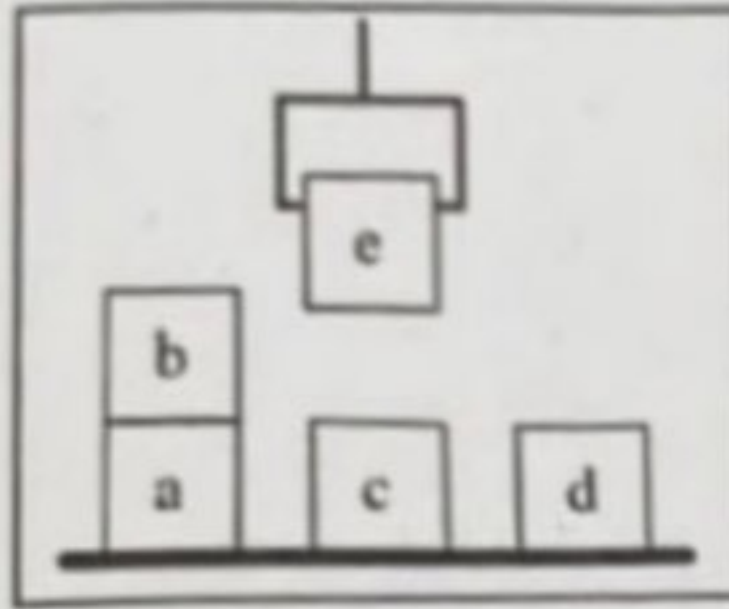
What is the output of the following queries:

?- magic(house_elf).

?- magic('McGonagall').

?- magic(wizard).

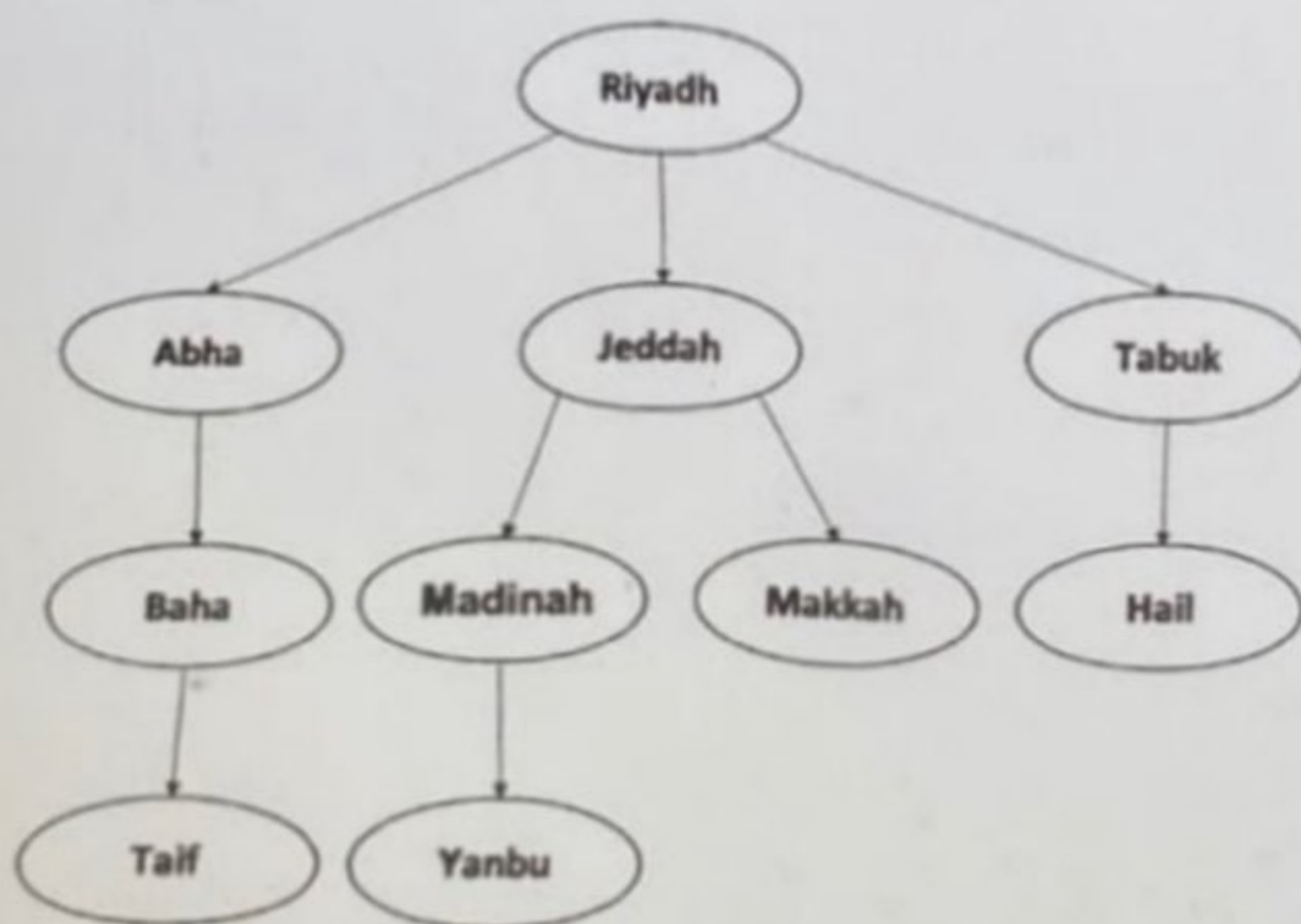
Use the following set of predicates: ($on(X,Y)$, $ontable(X)$, $clear(X)$, $gripping(X)$), write a state that describes the below figure about blocks world. (2 marks)



END OF EXAMINATION

Q5. Demonstrate the complete trace of **Breadth First Search (BFS)** for the following tree from **Riyadh (start state)** to **Madinah (goal state)**. Where your trace must show the **OPEN** and **CLOSE** lists.

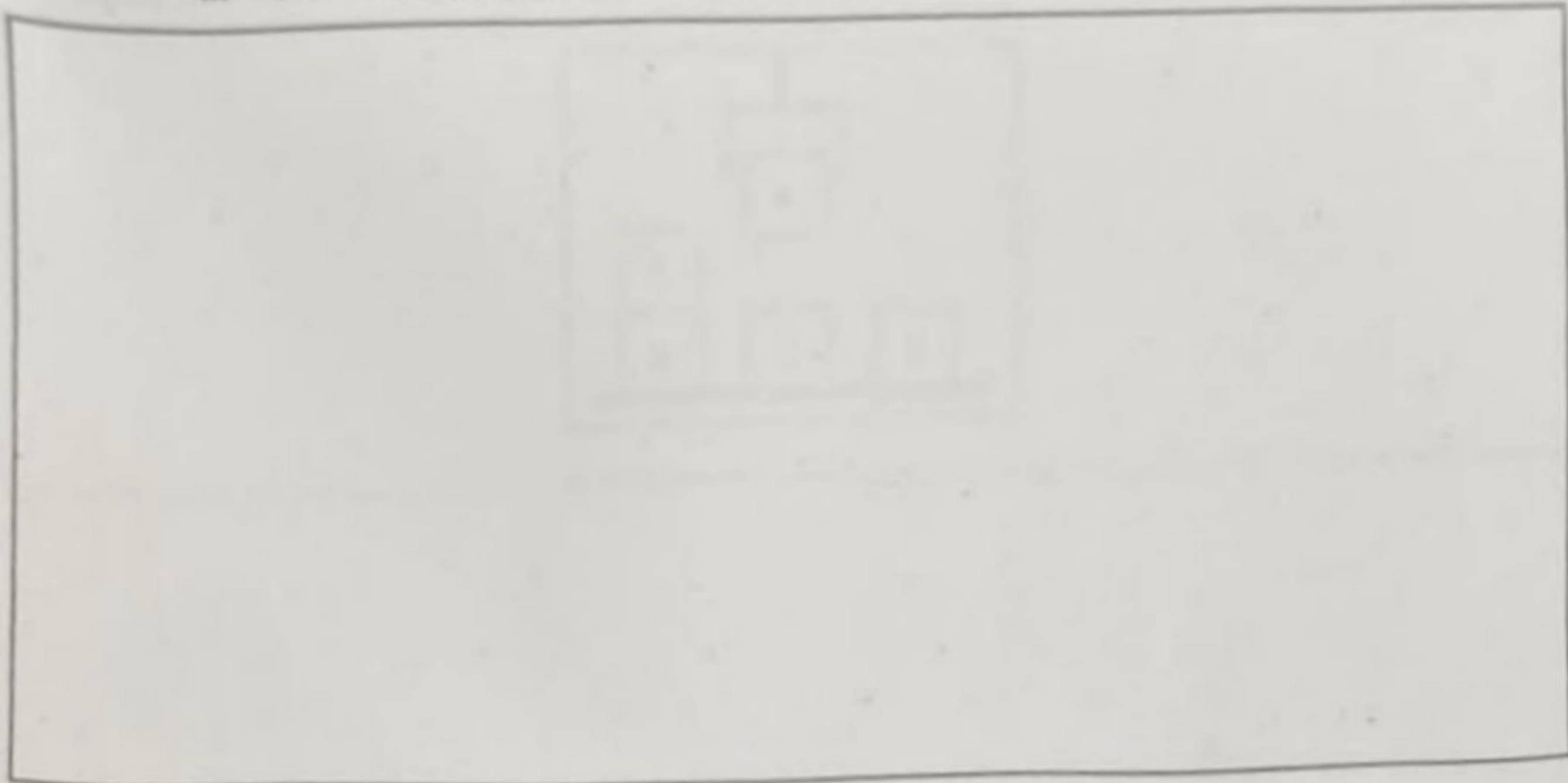
(3 marks)



Q6. Draw a conceptual graph for the following English sentence:

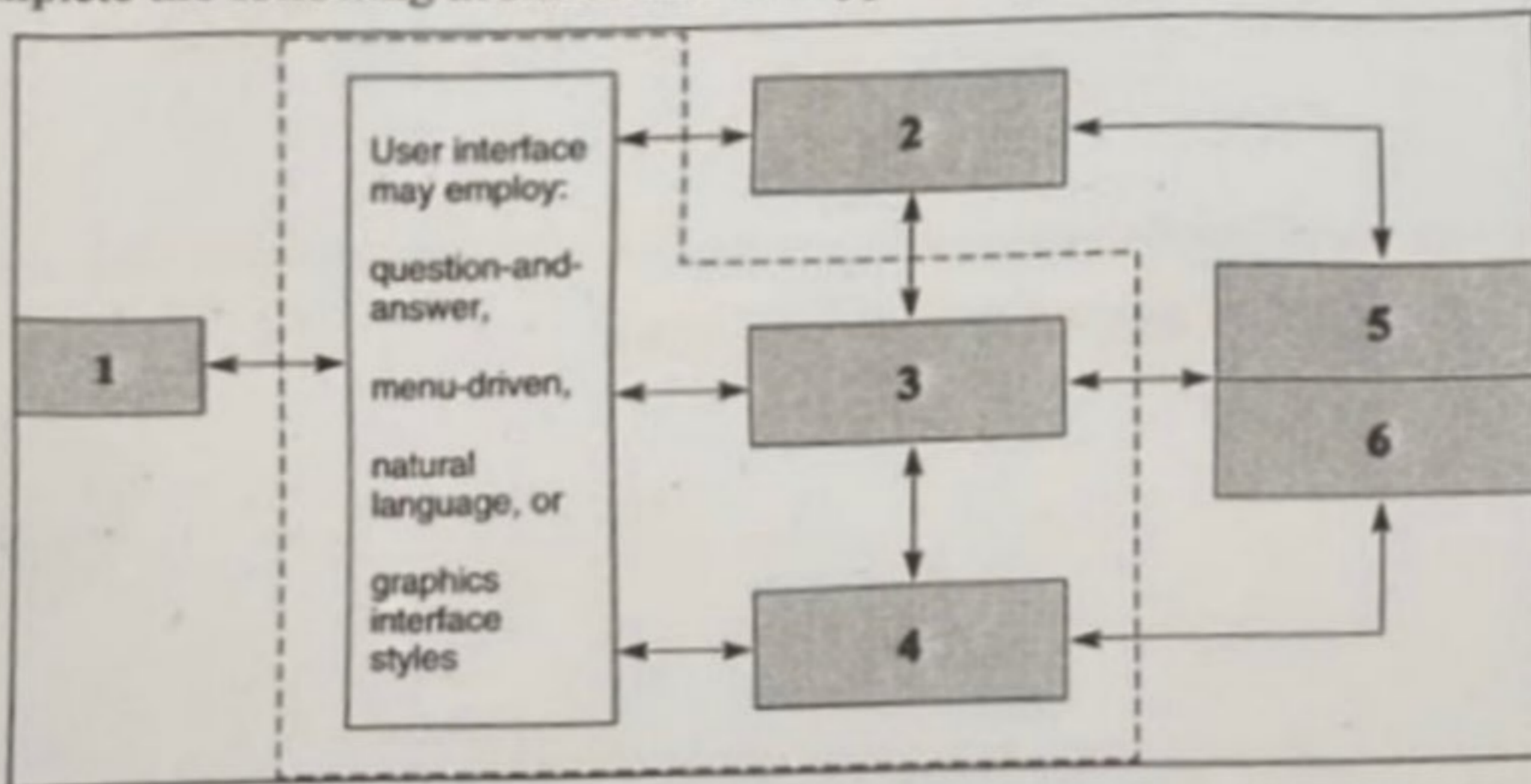
(2 marks)

a. "Norah is not tall"



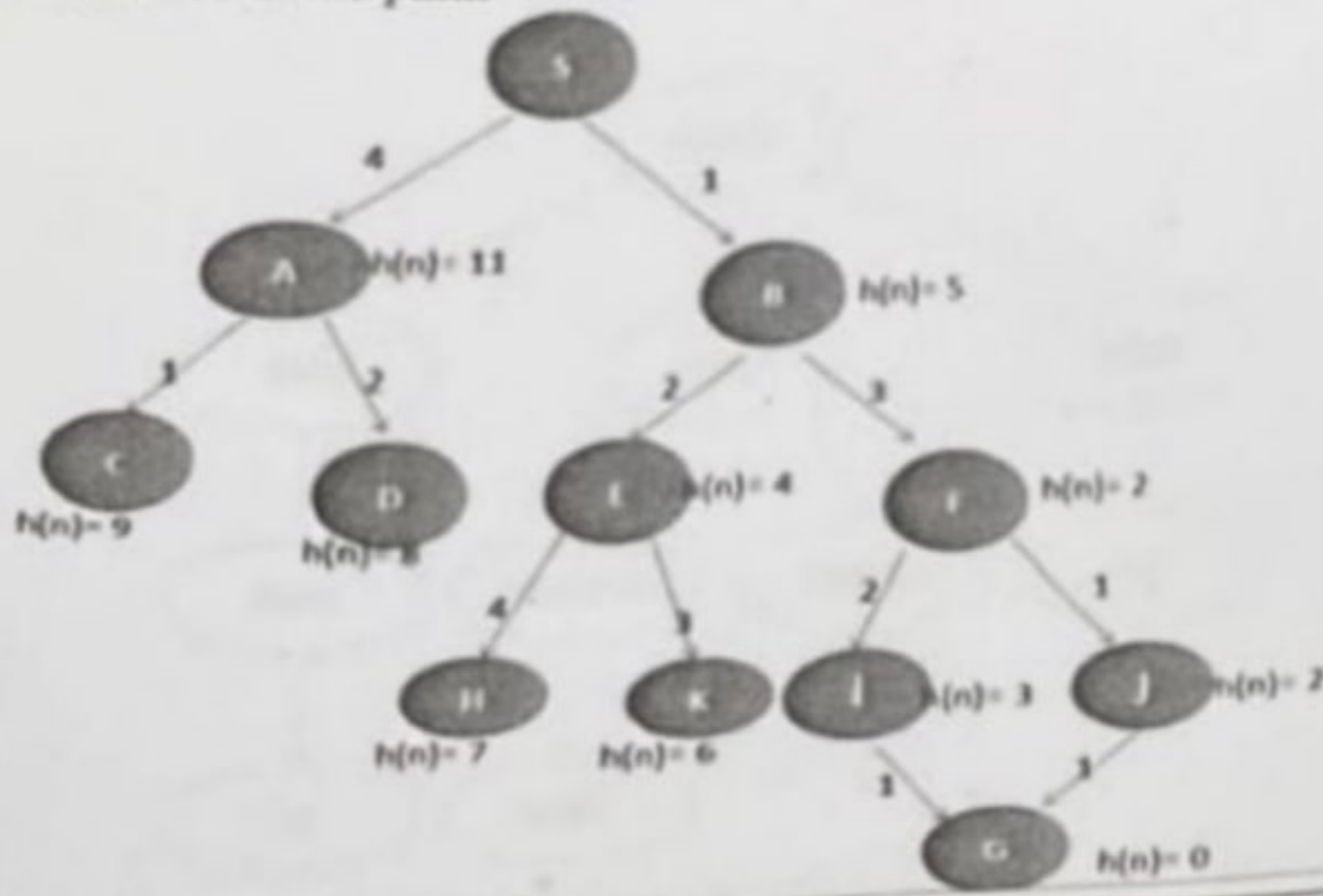
Q7. Complete the following architecture of a typical expert system for a particular domain.

(3 marks)

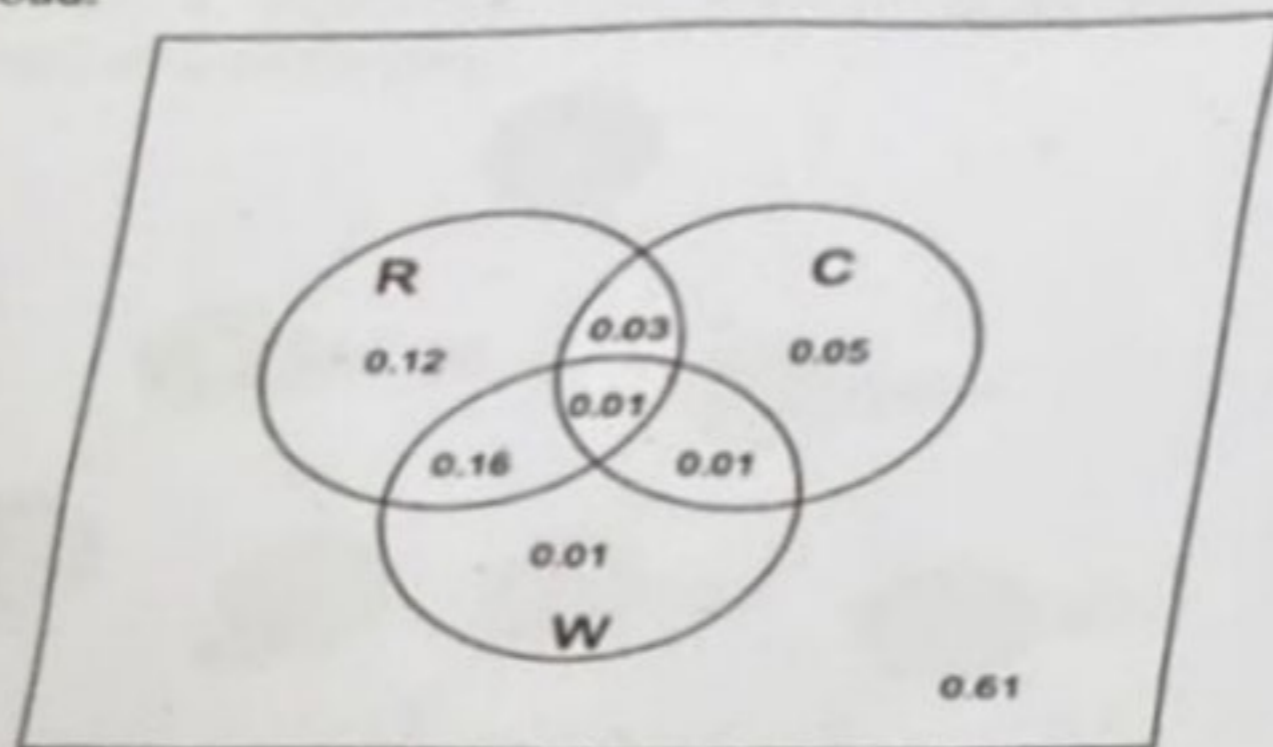


1	
2	
3	
4	
5	
6	

Given the figure below, find the **shortest path** and **cost** to reach the goal state (G) from the start state (S) using **A* algorithm**. Show clearly the calculations steps using the evaluation function for each node in the path. (3 marks)



Q3. Considering the following Venn diagram, where R represents rain, W represents wind, and C represents cloud. (2 marks)



a. What is the probability to have both a rainy day and not having a cloud?

Blank box for answer to question a.

b. What is the probability to have a rainy day if there is a cloud?

Blank box for answer to question b.



Student Name:

Student no.:

Section A: Multiple Choice Questions (30 marks)

There are 50 multiple choices questions, please circle the letter corresponding to the correct answer in your questions paper and then darken your answers in the answer sheet. All MCQs carry equal marks.

- 1) What will be translation of " $\forall X. \text{block}(X) \rightarrow \exists Y. \text{on}(X, Y)$ " in simple English?
 a. Every block is on something
 b. Every block is on every thing
 c. At least one block is on something
 d. At least one block is on something
- 2) Sentence, $(B \wedge L) \rightarrow M$ is equivalent to which of the following?
 a. $B \vee \neg L \vee M$
 b. $\neg B \vee \neg L \vee M$
 c. $B \vee L \vee M$
 d. $\neg B \vee \neg L \vee \neg M$
- 3) In logical sentence, ' $P \vee Q$ ', the P and Q are referred to as.....?
 a. Disjuncts
 b. Conjuncts
 c. Consequence
 d. Premise
- 4) For propositional expressions P, Q and R, logical equivalence ' $P \rightarrow Q \equiv \neg Q \rightarrow \neg P$ ' is called.....?
 a. Modes Ponens law
 b. De Morgan's law
 c. Contrapositive law
 d. Associative law
- 5) What will be translation of "Umer has exactly one Car"?
 a. $\exists X \in \text{Car}. \text{has}(\text{Umer}, X) \wedge (\exists Y \in \text{Car}. \text{has}(\text{Umer}, Y) \rightarrow (Y = X))$
 b. $\exists X \in \text{Car}. \text{has}(\text{Umer}, X)$
 c. $\forall X \in \text{Car}. \text{has}(\text{Umer}, X) \wedge (\exists Y \in \text{Car}. \text{has}(\text{Umer}, Y) \rightarrow (Y = X))$
 d. $\exists X \in \text{Car}. \text{has}(\text{Umer}, X) \wedge (\forall Y \in \text{Car}. \text{has}(\text{Umer}, Y) \rightarrow (Y = X))$
- 6) There are many categories of expert systems problems. One of these is called, 'Diagnosis' which is defined as:
 a. forming high-level conclusions from collections of raw data
 b. determining the cause of malfunctions in complex situations based on observable symptoms
 c. projecting probable consequences of given situations
 d. comparing a system's observed behavior to its expected behavior

- 7) Which of the following component of Expert System performs the recognize-act control cycle?
- a. User Interface
 - b. Inference Engine
 - c. Knowledge-base
 - d. Explanation sub-system
- 8) Backward search in an expert system corresponds roughly to the process of testing in human problem solving:
- a. Data
 - b. Hypothesis
 - c. Knowledge
 - d. None
- 9) In Planning, the steps of a traditional robot are composed of the robot's?
- a. Pre-conditions
 - b. Post-conditions
 - c. Atomic actions
 - d. None
- 10) In planning using STRIPS, the operators are represented as 'triples' of descriptions. Which element of the triple, describes items that are removed from a state description to create the new state when the operator is applied?
- a. Delete list
 - b. Add list
 - c. Pre-conditions
 - d. None
- 11) A Single-Layer Feed-Forward Structure is a simple perceptron, and has :
- a. One input layer, one hidden layer, and one output layer
 - b. One input layer, one output layer and feed-back connection
 - c. One input layer, one output layer, and no feed-back connections
 - d. One input layer, one hidden layer, and no feed-back connections
- 12) Activation functions produce output values for each neuron in the Neural Networks. In which of the activation function, the output value of neuron is between 0 and 1?
- a. Sign function
 - b. Sigmoid function
 - c. Step function
 - d. None
- 13) In the terminology of Neural Networks, connections are called?
- a. Soma
 - b. Axon
 - c. Dendrites
 - d. Synapses
- 14) Which of the following function cannot be modeled by a Single-layer neural network?
- a. OR
 - b. AND
 - c. XOR
 - d. None

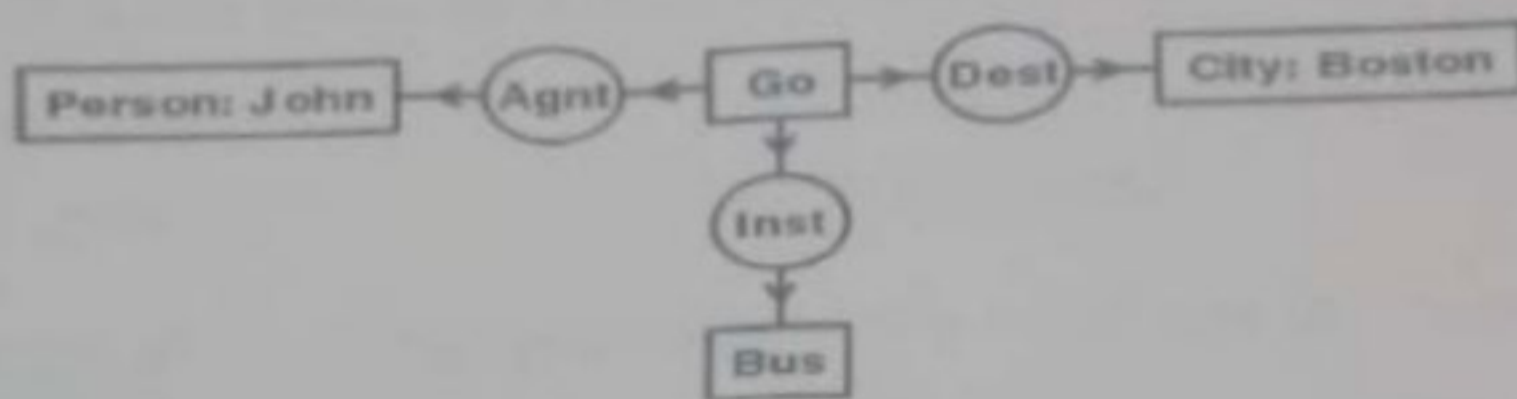
15) One of the properties of Semantic Networks is called, 'Inference'. What does it refer to?

- a. To perform inheritance
- b. To describe associations between concepts
- c. To describe facts or concepts
- d. To find a path between nodes

16) In conceptual graph, if a graph contains two duplicate relations, then one of them may be deleted, along with all its arcs. What this operator is called?

- a. Simplify
- b. Join
- c. Restrict
- d. Copy

17) Following simple conceptual graph represents a sentence in English. What it is?



- a. "John goes to Boston by Bus"
- b. "John goes to Bus by Boston"
- c. "John goes to City by Bus"
- d. None

18) The Logic Theorist used which of the calculus as its representation medium?

- a. Predicate
- c. Both a & b
- b. Propositional
- d. None

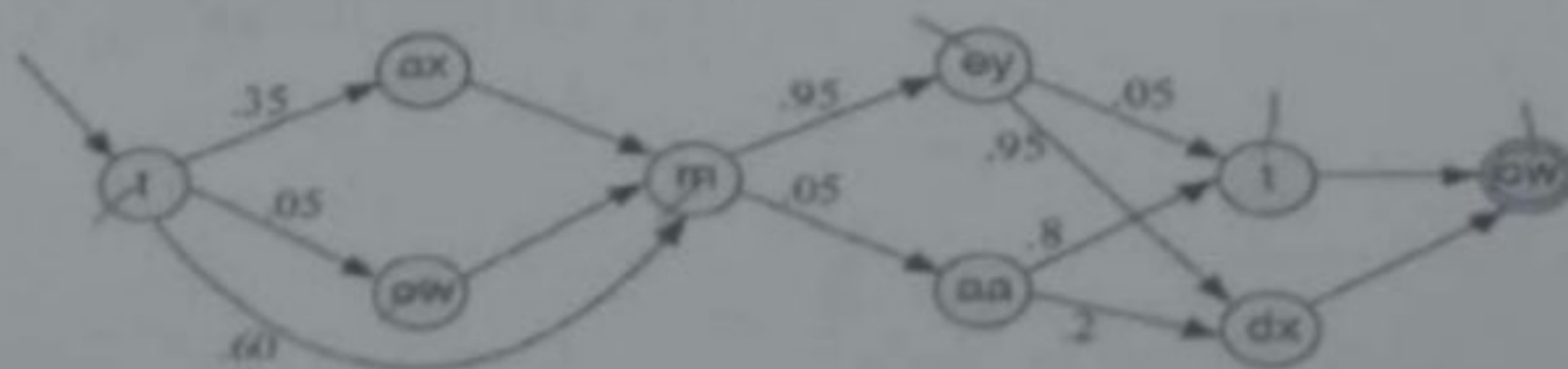
19) Resolution refutation proofs require that the axioms and the negation of the goal be placed in a normal form called

- a. Predicate form
- b. Clause form
- c. Unification form
- d. Substitution form

20) The Logic Theorist inference rules are substitution, replacement, and detachment. Which one of these three is also called 'Modes Ponens'?

- a. Substitution
- b. Replacement
- c. Detachment
- d. None

21) Based on the probabilistic finite state acceptor bellow, what is the percentage for the number of people that pronounce towmeytow?



- a. 0.6
- b. 0.2
- c. 0.8
- d. 0.05

- 22) Which one of the following related to the intelligent behavior:
- a. Determine what is important
 - b. Understand visual images
 - c. Process and manipulate symbols
 - d. All
- 23) Most of the appeal of automated theorem proving lies in the rigor and generality of:
- a. Logic
 - b. Search
 - c. Expert systems
 - d. Knowledge representation
- 24) A finite state machine (FSM) is a finite, directed, connected graph, having:
- a. A set of input values (I)
 - b. A state transition function(F)
 - c. A set of states (S)
 - d. All
- 25) ----- algorithm, the descendant states are added and removed from the left end of open list.
- a. In a depth-first search
 - b. In a breadth-first search
 - c. In a best-first search
 - d. In a A* search
- 26) In the Components of Learning Systems the ----- informs the learner of how well the agent is doing.
- a. Experiment Generator
 - b. Learning Element
 - c. Performance System
 - d. Critic
- 27) In hypothesis type, the ----- compare new (unlabeled) examples to ones you've memorized.
- a. Artificial neural network
 - b. Nearest neighbor
 - c. Bagging and boosting
 - d. Support vector machines
- 28) if you have 16 pool balls and you want to choose 3 of them, then the permutations with repetition is :
- a. $16! / 13!$
 - b. $16!$
 - c. $13!$
 - d. $3!$
- 29) If you have 16 pool balls and you want to choose 3 of them and nPr is $16!$ then the combination nCr is :
- a. $16! / 13!$
 - b. $16!$
 - c. $13!$
 - d. $16 \times 15 \times 13 / 3!$
- 30) what is the result of permutations $6 P 2$ is :
- a. 360
 - b. 30
 - c. 6
 - d. 4

31) Suppose the fire department mandates that all fire fighters must weigh between 150 and 250 pounds. The weight of a fire fighter would be an example of a:

- a. Continuous random variable
 b. Discrete random variable
 c. Boolean random variable
 d. None

32) if given event A is 3 elements and event B is 7 elements, and $P(B|A)$ is 0.2 then $P(A|B)$ is :

- a. $(0.2 \times 0.7) / 0.3$
 b. $(0.2 \times 0.3) / 0.7$
 c. $0.2 / 0.7$
 d. $0.3 / 0.7$

33) if given the node and goal bellow for 8-Puzzle Problem:

2 8 3	1 2 3
1 6 4	8 4
7 5	7 6 5
Node State	Goal State

Then the Tiles out of the place is :

- a. 6
 b. 5
 c. 4
 d. 7

34) IF the sample space is {win, lose} and $p(\text{win}) = 2/5$. The random variable for net (reward) winnings is $X(\text{win}) = 5$, $X(\text{lose}) = 2$, then the expected value for this event is:

- a. $4/5$
 b. 2
 c. 1
 d. $8/5$

35) -----is a technique for systematically trying all paths through a state space.

- a. Expert System
 b. Backtracking
 c. Machine Learning
 d. None

36) Machine Learning important, because-----.

- a. Some tasks cannot be defined well, except by examples.
 b. Human designers often produce machines that do not work as well as desired in the environments in which they are used.
 c. Relationships and correlations can be hidden within large amounts of data.
 d. All

37) The number of ways to arrange 5 objects that are chosen from a set of 7 different objects can be calculated as :

- a. $7P_5$
 b. $5P_7$
 c. $5C_7$
 d. $7C_5$

38) The two most fundamental concerns of AI researchers are:

- a. Intelligence and Knowledge Representation
- b. Search and Intelligence
- c. Knowledge Representation and Search
- d. Logic and Mind

39) What will be the translation of $\forall X. \text{father}(\text{Ahmed}, X) \rightarrow \text{married}(X)$?

- a. If Ahmed is a father then he is married
- b. Ahmed is a father and at least one of his child is married
- c. If Ahmed is a father then all his children are married
- d. Ahmed is a father and married

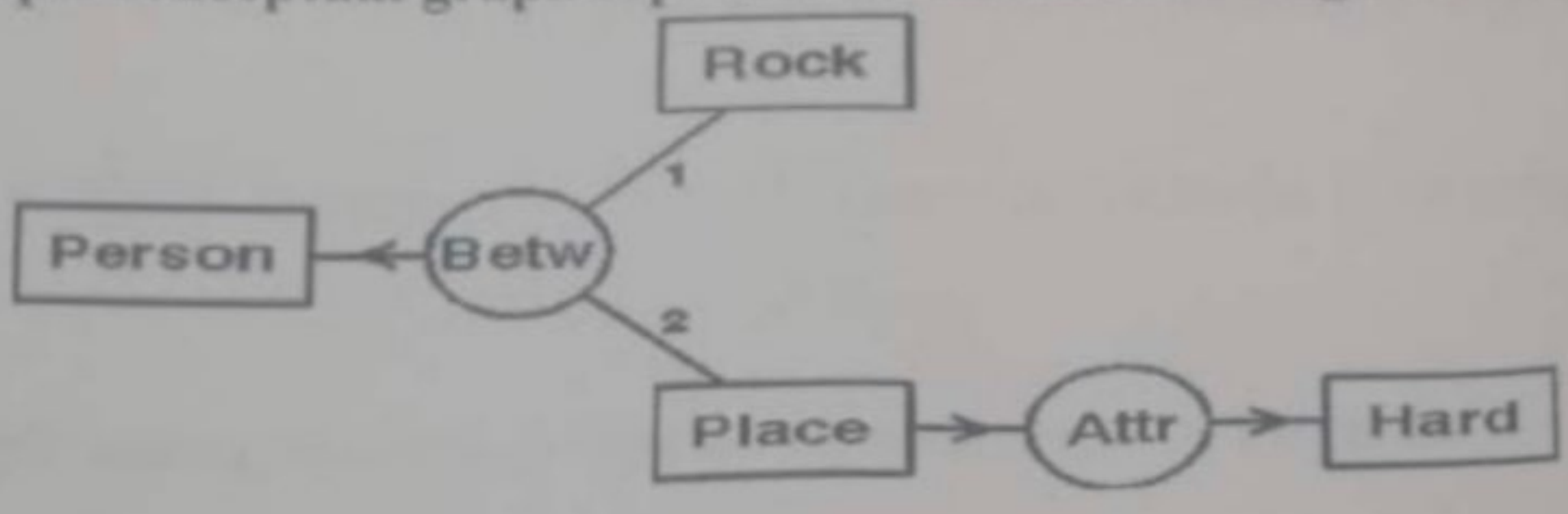
40) Which of the search technique is common in Data-driven expert systems?

- a. Heuristic search
- b. Best-first search
- c. Depth-first search
- d. Breadth-first search

41) A simplest type of neural network, which consists of a single neuron with adjustable synaptic weights and a hard limiter, is called:

- a. Perceptron
- b. RBF neural network
- c. Recurrent neural network
- d. Multi-layer neural network

42) Following simple conceptual graph represents a sentence in English. What it is?



- a. "A person is between rock and a place"
- b. "A person is between hard and rock "
- c. "A person is between a rock and a hard place"
- d. None

43) A semantic network consists of nodes and arcs. What does 'arc' correspond to?

- a. Inheritance
- b. Associations between concepts
- c. Facts or concepts
- d. Path between nodes

44) According to expert system component diagram (inference engine) is connected to

- a. Knowledge base acquisition facility
- b. Explanation facility
- c. Both a & b
- d. None

45) ----- is a system of programs and data structures that approximates the operation of the human brain.

- a. Intelligent Network
- b. Neural network
- c. Decision support system
- d. Genetic programming

46) ----- is a programming language that was designed for easy manipulation of data strings. It was developed in 1959 by John McCarthy and is still commonly used today in artificial intelligence (AI) programming.

- a. LISP
- b. Assembly language
- c. Machine code
- d. Ruby

47) Backward chaining is a ----- search technique.

- a. Data driven
- b. Goal driven
- c. Both a & b
- d. None

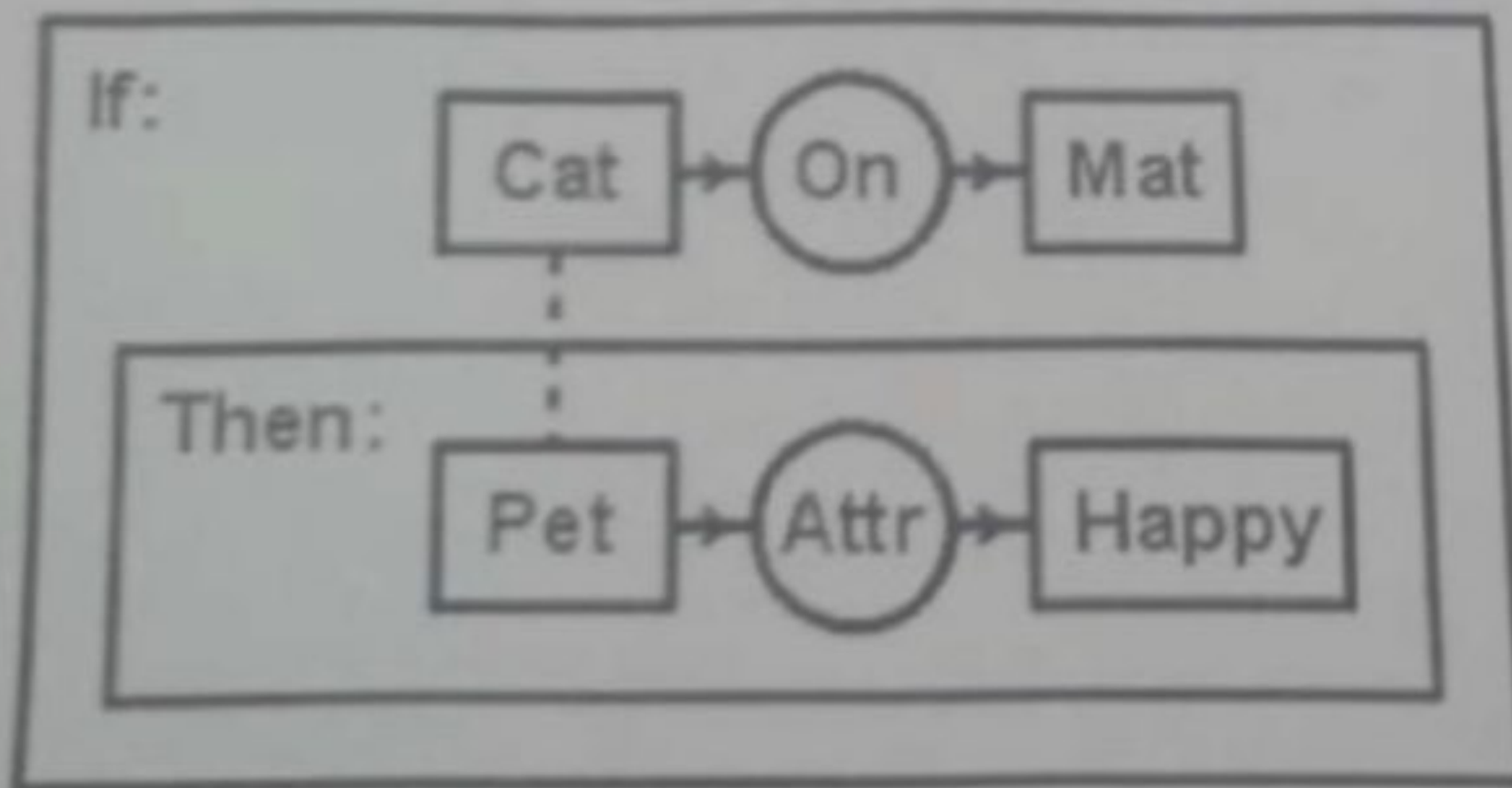
48) Games are good vehicles for AI research because:

- a. Most games are played using a well-defined set of rules
- b. Board configurations are easily represented on a computer
- c. Both a & b
- d. None

49) Knowledge Engineering: is an engineering discipline that involves integrating ----- into ----- in order to solve complex problems normally requiring a high level of human expertise.

- a. Knowledge, computer systems
- b. Computer systems, knowledge
- c. Both a & b
- d. None

50) Following simple conceptual graph represents a sentence in English. What it is?

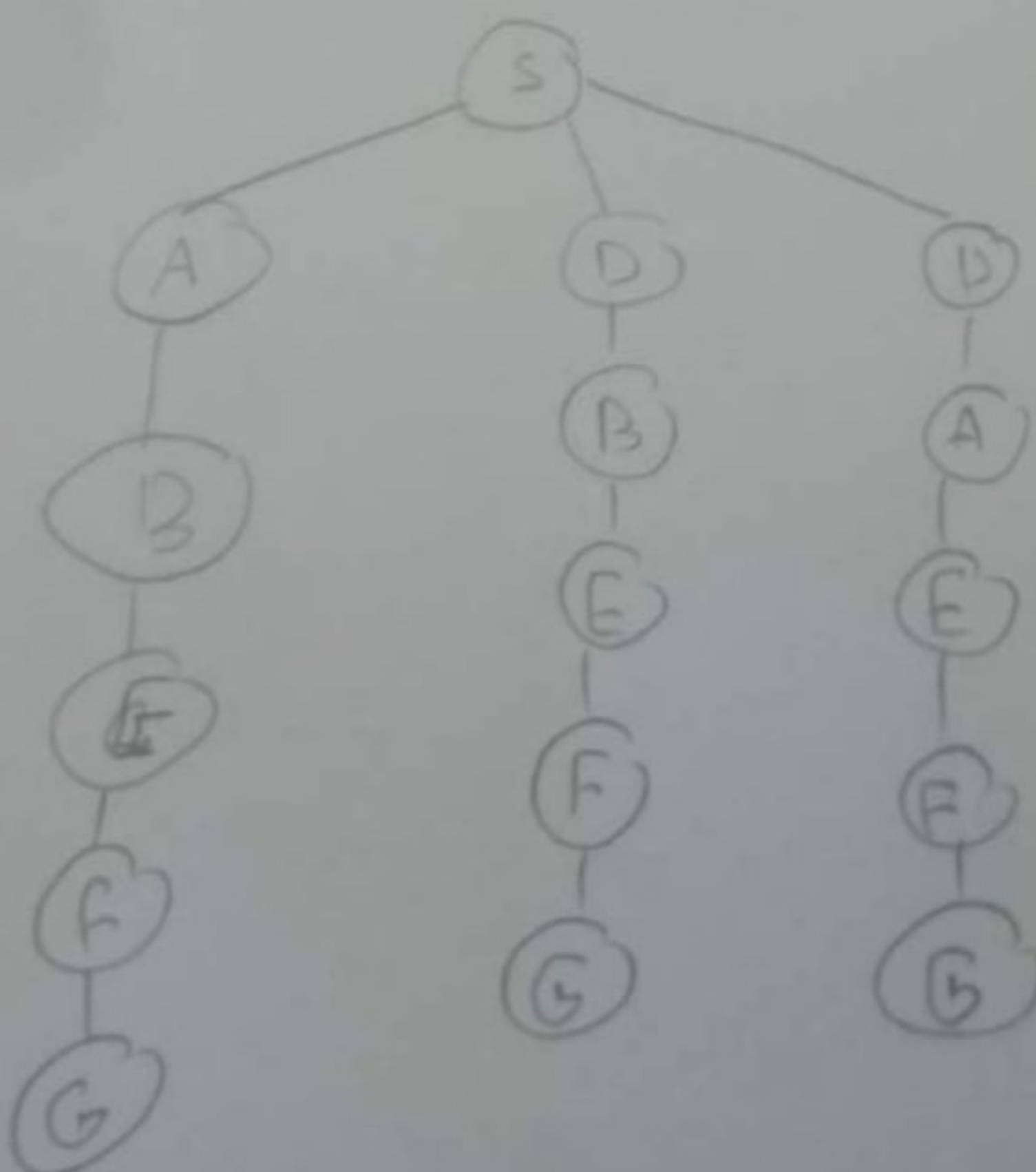
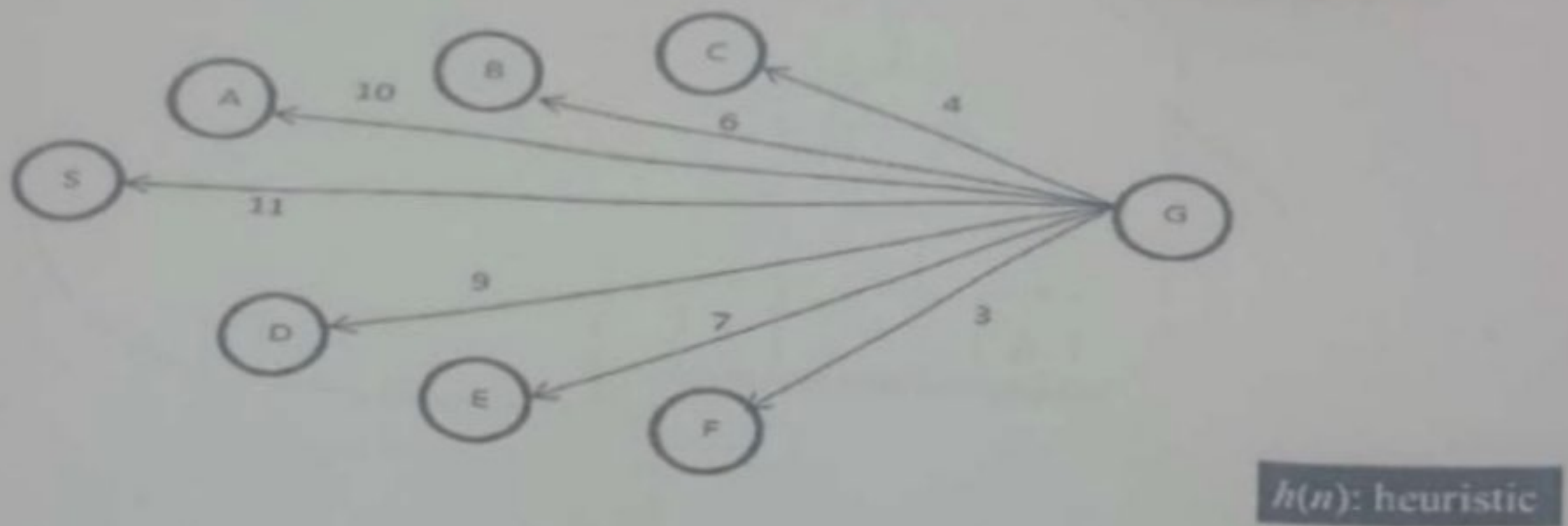
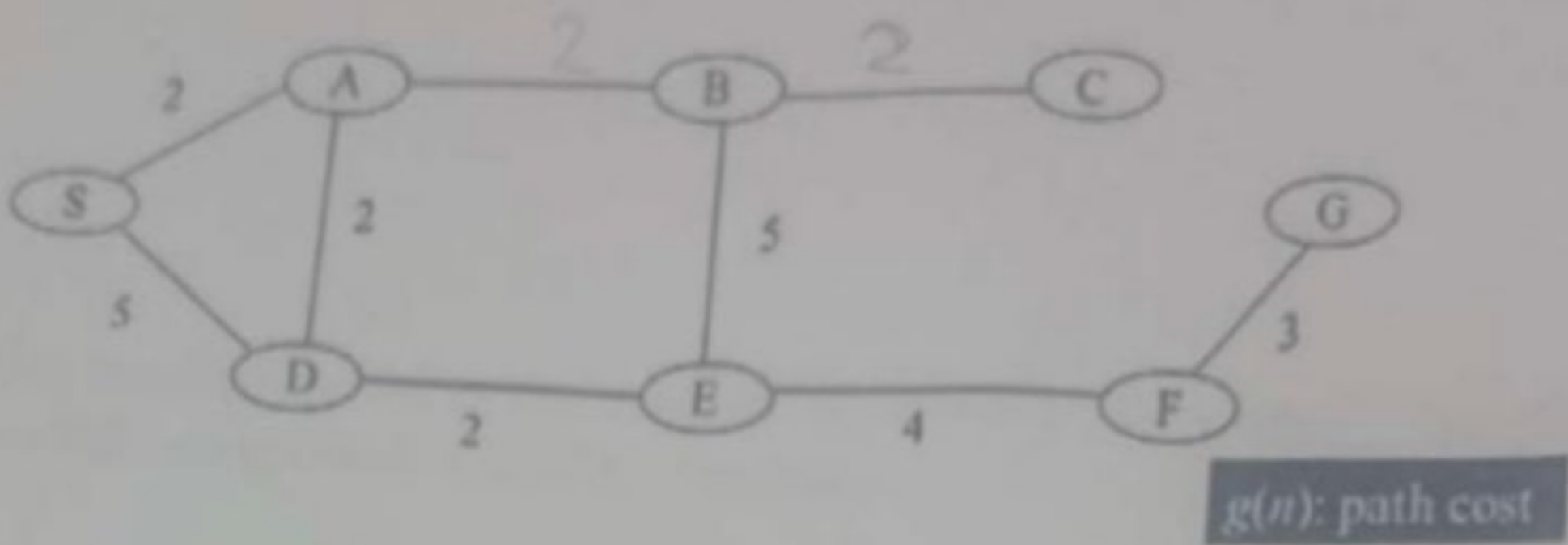


- a. "Cat is on a mat, and it is happy"
- b. "If a cat is on a mat, then it is a happy pet"
- c. "If a cat is on a mat, then it is happy"
- d. None

Section B: (10 marks)

Note: In this section you have 3 questions, where you have to answer your questions below each question on this questions paper.

Q1: This is a TSP search problem using Heuristics Search. For the following graphs, which show path cost, and heuristic values of nodes. Draw a tree, showing the values ($f(n) = g(n) + h(n)$) of each node. By applying A* algorithm, what will be the minimum path in the tree, if the initial node is 'S' and the goal node is 'G'? [Hint: Use values for $h(n)$ and for $g(n)$ shown in following two graphs respectively]. (4 marks)



	G(n)	H(n)
A	2	
B	5	
C	6	
D	9	
E	7	
F	3	
G	11	

Path	G(n)	H(n)
S-A-B-F-F-F-G	22	
S-D-B-E-F-F-G	24	
S-G-A-F-F-G	14	