

## Artificial Intelligence

1. Consider following two rules R1 and R2 in logical reasoning in Artificial Intelligence (AI):

R1 : From  $\alpha \supset \beta$   
and  $\alpha$   
Inter  $\beta$  is known as Modus Tollens (MT)

R2 : From  $\alpha \supset \beta$   
and  $\neg \beta$   
Inter  $\neg \alpha$  is known as Modus Ponens (MP)

- (1) Only R1 is correct.  
(2) Only R2 is correct.  
(3) Both R1 and R2 are correct.  
(4) Neither R1 nor R2 is correct.

Answer: 4

57. In Artificial Intelligence (AI), what is present in the planning graph?

- (1) Sequence of levels  
(2) Literals  
(3) Variables  
(4) Heuristic estimates

Answer: 1

58. What is the best method to go for the game playing problem?

- (1) Optimal Search  
(2) Random Search  
(3) Heuristic Search  
(4) Stratified Search

Answer: 3

56. Given a Turing Machine

$$M = (\{q_0, q_1\}, \{0, 1\}, \{0, 1, B\}, \delta, B, \{q_1\})$$

Where  $\delta$  is a transition function defined as

$$\delta(q_0, 0) = (q_0, 0, R)$$

$$\delta(q_0, B) = (q_1, B, R)$$

The language  $L(M)$  accepted by Turing machine is given as :

- (A)  $0^* 1^*$                       (B)  $00^*$   
(C)  $10^*$                          (D)  $1^*0^*$

Answer: B

64. What are the following sequence of steps taken in designing a fuzzy logic machine ?

- (A) Fuzzification  $\rightarrow$  Rule evaluation  $\rightarrow$  Defuzzification  
(B) Fuzzification  $\rightarrow$  Defuzzification  $\rightarrow$  Rule evaluation  
(C) Rule evaluation  $\rightarrow$  Fuzzification  $\rightarrow$  Defuzzification  
(D) Rule evaluation  $\rightarrow$  Defuzzification  $\rightarrow$  Fuzzification

70. Let  $v(x)$  mean  $x$  is a vegetarian,  $m(y)$  for  $y$  is meat, and  $e(x, y)$  for  $x$  eats  $y$ . Based on these, consider the following sentences:

- I.  $\forall x v(x) \Leftrightarrow (\forall y e(x, y) \Rightarrow \neg m(y))$   
II.  $\forall x v(x) \Leftrightarrow (\neg(\exists y m(y) \wedge e(x, y)))$   
III.  $\forall x (\exists y m(y) \wedge e(x, y)) \Leftrightarrow \neg v(x)$   
One can determine that

- (A) Only I and II are equivalent sentences
- (B) Only II and III are equivalent sentences.
- (C) Only I and III are equivalent sentence.
- (D) I, II, and III are equivalent sentences.

Answer: D

71. Match each Artificial Intelligence term in List-I that best describes a given situation in List – II:

**List – I**

- I. Semantic Network
- II. Frame
- III. Declarative knowledge
- IV. Primitive knowledge.

**List – II**

- a. Knowledge about what to do as opposed to how to do it.
- b. A premise of a rule that is not concluded by any rule.
- c. A method of knowledge representation that uses a graph.
- d. A data structure representing stereotypical knowledge.

**Codes :**

- |     |   |    |     |    |
|-----|---|----|-----|----|
|     | I | II | III | IV |
| (A) | d | a  | b   | c  |
| (B) | d | c  | a   | b  |
| (C) | d | c  | b   | a  |
| (D) | c | d  | a   | b  |

Answer: D

72. In Artificial Intelligence , a semantic network
- (A) is a graph-based method of knowledge representation where nodes represent concepts and arcs represent relations between concepts.
  - (B) is a graph-based method of knowledge representation where nodes represent relations between concepts and arcs represent concepts.
  - (C) represents an entity as a set of slots and associated rules.
  - (D) is a subset of first-order logic.

Answer: A

73. Criticism free idea generation is a factor of .....
- (A) Decision Support System
  - (B) Group Decision Support System
  - (C) Enterprise Resource Support System
  - (D) Artificial Intelligence

Answer: B

74. Consider the following logical inferences :
- I<sub>1</sub> : If it is Sunday then school will not open.  
The school was open.  
Inference : It was not Sunday.
- I<sub>2</sub> : If it is Sunday then school will not open.  
It was not Sunday.  
Inference : The school was open.
- Which of the following is correct?

- (A) Both  $I_1$  and  $I_2$  are correct inferences.
- (B)  $I_1$  is correct but  $I_2$  is not a correct inference.
- (C)  $I_1$  is not correct but  $I_2$  is a correct inference.
- (D) Both  $I_1$  and  $I_2$  are not correct inferences.

Answer: B

75. Which formal system provides the semantic foundation for Prolog?
- (A) Predicate calculus
  - (B) Lambda calculus
  - (C) Hoare logic
  - (D) Propositional logic

Answer: A

8. Forward chaining systems are ..... where as backward chaining systems are .....
- (A) Data driven, Data driven
  - (B) Goal driven, Data driven
  - (C) Data driven, Goal driven
  - (D) Goal driven, Goal driven

Answer: C

59. Match the following with respect to heuristic search techniques:

**List-I**

**List-II**

- (a) Steepest-descent Hill Climbing
  - (b) Branch-and-bound
  - (c) Constraint satisfaction
  - (d) Means-end-analysis
- (i) Keeps track of all partial paths which can be candidate for further exploration
  - (ii) Discover problem state(s) that satisfy a set of constraints
  - (iii) Detects difference between current state and goal state
  - (iv) Considers all moves from current state and selects best move

**Codes:**

- (a) (b) (c) (d)
- (A) (i) (iv) (iii) (ii)
- (B) (iv) (i) (ii) (iii)
- (C) (i) (iv) (ii) (iii)
- (D) (iv) (ii) (i) (iii)

Answer: B

59. Match the following components of an expert system :

- a. I/O interface
  - b. Explanation module
  - c. Inference engine
  - d. Knowledge base
- i. Accepts user's queries and responds to question through I/O interface
  - ii. Contains facts and rules about the domain
  - iii. Gives the user, the ability to follow inferencing steps at any time during consultation
  - iv. Permits the user to communicate with the system in a natural way

**Codes :**

- a b c d
- (A) i iii iv ii
- (B) iv iii i ii
- (C) i iii ii iv

(D) iv i iii ii

Answer: B

56. An A\* algorithm is a heuristic search technique which

- (A) is like a depth-first search where most promising child is selected for expansion
- (B) generates all successor nodes and computes an estimate of distance (cost) from start node to a goal node through each of the successors. It then chooses the successor with shortest cost.
- (C) saves all path lengths (costs) from start node to all generated nodes and chooses shortest path for further expansion.
- (D) none of the above

Answer: B

28. Match the following :

**List – I**

- a. Expert systems
- b. Planning
- c. Prolog
- d. Natural language processing

**List – II**

- i. Pragmatics
- ii. Resolution
- iii. Means-end analysis
- iv. Explanation facility

**Codes :**

a b c d

(A) iii iv i ii

(B) iii iv ii i

(C) i ii iii iv

(D) iv iii ii i

Answer: D

29. STRIPS addresses the problem of efficiently representing and implementation of a planner. It is not related to which one of the following?

- (A) SHAKEY
- (B) SRI
- (C) NLP
- (D) None of these

Answer: C

30. Slots and facets are used in

- (A) Semantic Networks
- (B) Frames
- (C) Rules
- (D) All of these

Answer: B

1. Which of the following is a correct predicate logic statement for “Every Natural number has one successor”?

- (A)  $\forall x \exists y (\text{succ}(x, y) \wedge (\exists z \text{succ}(x, z) \Rightarrow \text{equal}(y, z)))$
- (B)  $\forall x \exists y (\text{succ}(x, y) \vee (\exists z \text{succ}(x, z) \Rightarrow \text{equal}(y, z)))$
- (C)  $\exists y \forall x (\text{succ}(x, y) \wedge (\exists z \text{succ}(x, z) \Rightarrow \text{equal}(y, z)))$
- (D)  $\forall x \exists y \text{succ}(x, y)$

Answer: A

2.  $\alpha - \beta$  cutoffs are applied to .....

- (A) Depth first search
- (B) Best first search
- (C) Minimax search
- (D) Breadth first search

Answer: C

3. Assume that each alphabet can have a value between 0 to 9 in a cryptarithmic problem

```
CROSS
+ROADS
-----
DANGER
-----
```

Which of the following statement is true?

- (i) No two alphabets can have the same numeric value.
  - (ii) Any two alphabets may have the same numeric value.
  - (iii)  $D = 0$
  - (iv)  $D = 1$
- (A) (i) and (iii)
  - (B) (i) and (iv)
  - (C) (ii) and (iii)
  - (D) (ii) and (iv)

Answer: B

4. Which of the following is not a part of an expert system shell?

- (A) Knowledge Base
- (B) Inference Engine
- (C) Explanation Facility
- (D) None of the above

Answer: A

5. The Blocks World Problem in Artificial Intelligence is normally discussed to explain a .....

- (A) Search technique
- (B) Planning system
- (C) Constraint satisfaction system

(D) Knowledge base system

Answer: B

6. Means-Ends Analysis process centres around the detection of difference between the current state and the goal state. Once such a difference is found, then to reduce the difference one applies

.....

- (A) a forward search that can reduce the difference.
- (B) a backward search that can reduce the difference.
- (C) a bidirectional search that can reduce the difference.
- (D) an operator that can reduce the difference.

Answer: D

22. The clausal form of the disjunctive normal form  $\neg A \vee \neg B \vee \neg C \vee D$  is:

- (A)  $A \wedge B \wedge C \Rightarrow D$
- (B)  $A \vee B \vee C \vee D \Rightarrow \text{true}$
- (C)  $A \wedge B \wedge C \wedge D \Rightarrow \text{true}$
- (D)  $A \wedge B \wedge C \wedge D \Rightarrow \text{false}$

Answer: A

24. Which one of the following is true?

- (A) The resolvent of two Horn clauses is not a Horn clause.
- (B) The resolvent of two Horn clauses is a Horn Clause.
- (C) If we resolve a negated goal G against a fact or rule A to get Clause C then C has positive literal and non null-goal.
- (D) If we resolve a negated goal G against a fact or rule A to get clause C then C has positive literal or null goal.

Answer: B

55. Match the following:

**List-I**

- (a) Intelligence
- (b) Knowledge
- (c) Information
- (d) Data

**List-II**

- (i) Contextual, tacit, transfer needs learning
- (ii) Scattered facts, easily transferrable
- (iii) Judgemental
- (iv) Codifiable, endorsed with relevance and purpose

**Codes:**

- (a) (b) (c) (d)
- (A) (iii) (ii) (iv) (i)
- (B) (iii) (i) (iv) (ii)
- (C) (i) (ii) (iii) (iv)
- (D) (i) (iii) (iv) (ii)

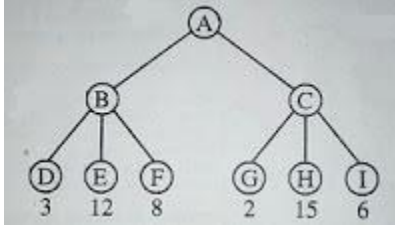
Answer: B

72. How does randomized hill-climbing choose the next move each time?

- (A) It generates a random move from the moveset, and accepts this move.
- (B) It generates a random move from the whole state space, and accepts this move.
- (C) It generates a random move from the moveset, and accepts this move only if this move improves the evaluation function.
- (D) It generates a random move from the whole state space, and accepts this move only if this move improves the evaluation function.

Answer: C

73. Consider the following game tree in which root is a maximizing node and children are visited left to right. What nodes will be pruned by the alpha-beta pruning?



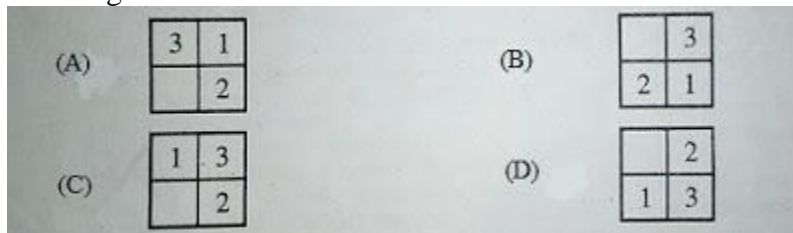
- (A) I                      (B) HI  
(C) CHI                  (D) GHI

Answer: B

- Consider a 3-puzzle where, like in the usual 8-puzzle game, a tile can only move to an adjacent empty space. Given the initial state



74. which of the following state cannot be reached?



Answer: C

75. A software program that infers and manipulates existing knowledge in order to generate new knowledge is known as:  
(A) Data Dictionary                      (B) Reference Mechanism  
(C) Inference Engine                      (D) Control Strategy

Answer: C

34. Horn clauses are special kinds of propositions which can be described as  
(A) Single atomic proposition on left side.  
(B) Single or multiple atomic proposition on left side.  
(C) A single atomic proposition on left side and a single atomic proposition on right side.  
(D) A single atomic proposition on left side or an empty left side.

Answer: D

**Explanation:**

A Horn clause is a unique kind of proposition which has either one single proposition on the left hand side or an empty proposition. When a Horn clause does contain a proposition on the left side, it is sometimes referred to as a headed Horn clause.

35. Which of the following is/are the fundamental semantic model(s) of parameter passing?

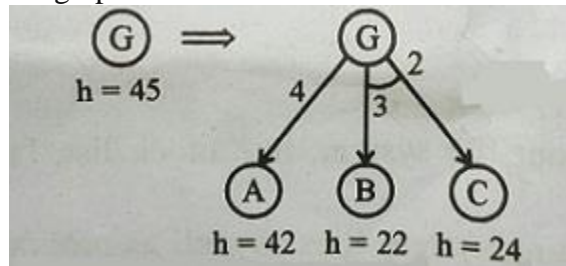
- (A) in mode
- (B) out mode
- (C) in-out mode
- (D) all of the above

Answer: D

**Explanation:**

There are three fundamental semantics models of Parameter passing - In-mode, Out-mode and In-out mode.

56. Consider the following AO graph:



Which is the best node to expand next by AO\* algorithm?

- (1) A
- (2) B
- (3) C
- (4) B and C

Answer: 1

59. Which of the following statements is true?

- (1) The sentence  $S$  is a logical consequence of  $S_1, \dots, S_n$  if and only if  $S_1 \wedge S_2 \wedge \dots \wedge S_n \rightarrow S$  is satisfiable.
- (2) The sentence  $S$  is a logical consequence of  $S_1, \dots, S_n$  if and only if  $S_1 \wedge S_2 \wedge \dots \wedge S_n \rightarrow S$  is valid.
- (3) The sentence  $S$  is a logical consequence of  $S_1, \dots, S_n$  if and only if  $S_1 \wedge S_2 \wedge \dots \wedge S_n \wedge \neg S$  is consistent.
- (4) The sentence  $S$  is a logical consequence of  $S_1, \dots, S_n$  if and only if  $S_1 \wedge S_2 \wedge \dots \wedge S_n \wedge S$  is inconsistent.

Answer: 2

34. Horn clauses are special kinds of propositions which can be described as

- (A) Single atomic proposition on left side.
- (B) Single or multiple atomic proposition on left side.
- (C) A single atomic proposition on left side and a single atomic proposition on right side.
- (D) A single atomic proposition on left side or an empty left side.

Answer: D

**Explanation:**

A Horn clause is a unique kind of proposition which has either one single proposition on the left hand side or an empty proposition. When a Horn clause does contain a proposition on the left side, it is sometimes referred to as a headed Horn clause.

35. Which of the following is/are the fundamental semantic model(s) of parameter passing?

- (A) in mode
- (B) out mode



- (C) in-out mode
- (D) all of the above

Answer: D

**Explanation:**

There are three fundamental semantics models of Parameter passing - In-mode, Out-mode and In-out mode.

67. Which one of the following is a correct implementation of the metapredicate “not” in PROLOG (Here G represents a goal)?

- (A)  $\text{not}(G):- !, \text{call}(G), \text{fail}.$   
 $\text{not}(G).$
- (B)  $\text{not}(G):- \text{call}(G), !, \text{fail}.$   
 $\text{not}(G).$
- (C)  $\text{not}(G):- \text{call}(G), \text{fail}, !.$   
 $\text{not}(G).$
- (D)  $\text{not}(G):- \text{call}(G), \text{fail}.$   
 $\text{not}(G):- !.$

Answer: B

68. Which one of the following is not an informed search technique?

- (A) Hill climbing search
- (B) Best first search
- (C) A\* search
- (D) Depth first search

Answer: D

23. High level knowledge which relates to the use of sentences in different contexts and how the context affect the meaning of the sentences?

- (A) Morphological
- (B) Syntactic
- (C) Semantic
- (D) Pragmatic

Answer: D

24. The objective of ..... procedure is to discover at least one ..... that causes two literals to match.

- (A) unification, validation
- (B) unification, substitution
- (C) substitution, unification
- (D) minimax, maximum

Answer: B

25. If  $h^*$  represents an estimate of the cost of getting from the current node N to the goal node and  $h$  represents actual cost of getting from current node to the goal node, then A\* algorithm gives an optimal solution if

- (A)  $h^*$  is equal to  $h$
- (B)  $h^*$  overestimates  $h$
- (C)  $h^*$  underestimates  $h$
- (D) none of these

Answer: C

26. The mean-end analysis process centers around the detection of differences between the current state and the goal state. Once such a difference is isolated, an operator that can reduce the difference must be found. But perhaps that operator cannot be applied to the current state. So a sub-problem of getting to a state in which it can be applied is set up. The kind of backward chaining in which operators are selected and then sub goals are set up to establish the precondition of operators is called

- (A) backward planning
- (B) goal stack planning
- (C) operator subgoaling
- (D) operator overloading

Answer: C

67. An expert system shell is an expert system without

- (A) domain knowledge
- (B) explanation facility
- (C) reasoning with knowledge
- (D) all of the above

Answer: A

72. A cryptarithmic problem of the type

SEND  
+ MORE  
-----  
MONEY

Can be solved efficiently using

- (A) depth first technique
- (B) breadth first technique
- (C) constraint satisfaction technique
- (D) bidirectional technique

Answer: C

73. Match the following :

**List - I**

- a. Supervised learning
- b. Unsupervised learning
- c. Reinforcement learning
- d. Inductive learning

**List - II**

- 1. The decision system receives rewards for its action at the end of a sequence of steps.
- 2. Manual labels of inputs are not used.
- 3. Manual labels of inputs are used.
- 4. System learns by example

**Codes :**

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | a | b | c | d |
| (A) | 1 | 2 | 3 | 4 |
| (B) | 2 | 3 | 1 | 4 |
| (C) | 3 | 2 | 4 | 1 |
| (D) | 3 | 2 | 1 | 4 |

Answer: D

58. Skolemization is the process of



- (C) if-else (G, P,  $\square$ ) :- call(G), call(P), !.
- if-else (G, P,  $\square$ ) :- call( $\square$ ).

(D) All of the above

Answer: B

6. If two fuzzy sets A and B are given with membership functions

$$\mu_A(x) = \{0.2, 0.4, 0.8, 0.5, 0.1\}$$

$$\mu_B(x) = \{0.1, 0.3, 0.6, 0.3, 0.2\}$$

Answer: Wrong question

23. Which one of the following prolog programs correctly implement “if G succeeds then execute goal P else execute goal  $\square$ ?”

(A) if-else (G, P,  $\square$ ) :- !, call(G), call(P).

if-else (G, P,  $\square$ ) :- call( $\square$ ).

(B) if-else (G, P,  $\square$ ) :- call(G), !, call(P).

if-else (G, P,  $\square$ ) :- call( $\square$ ).

(C) if-else (G, P,  $\square$ ) :- call(G), call(P), !.

if-else (G, P,  $\square$ ) :- call( $\square$ ).

(D) All of the above

Answer: B

71. The map colouring problem can be solved using which of the following technique?

(A) Means-end analysis

(B) Constraint satisfaction

(C) AO\* search

(D) Breadth first search

Answer: B

72. Which of the following is a knowledge representation technique used to represent knowledge about stereotype situation?

(A) Semantic network

(B) Frames

(C) Scripts

(D) Conceptual Dependency

Answer: C

32. .... predicate calculus allows quantified variables to refer to objects in the domain of discourse and not to predicates or functions.

(A) Zero-order

(B) First-order

(C) Second-order

(D) High-order

Answer: B

31. Consider  $f(N) = g(N) + h(N)$  Where function g is a measure of the cost of getting from the start node to the current node N and h is an estimate of additional cost of getting from the current node N to the goal node. Then  $f(N) = h(N)$  is used in which one of the following algorithms?

(A) A\* algorithm

(B) AO\* algorithm

- (C) Greedy best first search algorithm
- (D) Iterative A\* algorithm

Answer: C

43. A horn clause is .....
- (A) A clause in which no variables occur in the expression
  - (B) A clause that has at least one negative literal
  - (C) A disjunction of a number of literals
  - (D) A clause that has at most one positive literal

Answer: D

45. Reasoning strategies used in expert systems include .....
- (A) Forward chaining, backward chaining and problem reduction
  - (B) Forward chaining, backward chaining and boundary mutation
  - (C) Forward chaining, backward chaining and back propagation
  - (D) Backward chaining, problem reduction and boundary mutation

Answer: A