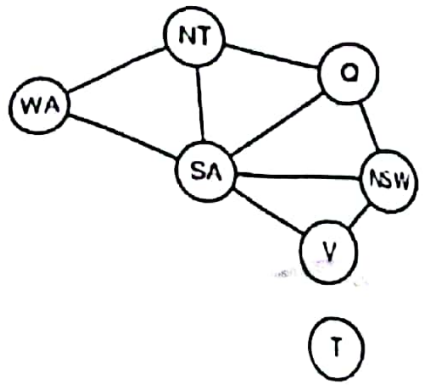
Shahjalal University of Science and Technology
Institute of Information and Communication Technology
Software Engineering
3rd Year 1st Semester Term Test 02 (Session: 2019-20)
Course Code: SWE 443 323 Credits: 3 Course Title: Artificial Intelligence
Time: 40 minutes Total Marks: 30

1 Answer all the following questions

Suppose Genetic algorithm is used to find the solution of the equality a + 2b + 3c + 4d = 30 **10**
The objective here is to minimize f(x) where f(x) = abs((a + 2b + 3c + 4d) – 30) The chromosome is defined as [a, b, c, d] where a, b, c, d are integers between 0 and 30 Initially there are 6 chromosomes in the population
Chromosome1 = [12, 5, 23, 8] Chromosome2 = [2, 21, 18, 3]
Chromosome3 = [10, 4, 13, 14] Chromosome4 = [20, 1, 10, 6]
Chromosome5 = [1, 4, 13, 19] Chromosome6 = [20, 5, 17, 1]

a) Calculate the fitness of all individuals with f(x)
b) Select candidate parents using truncation selection with f = 50%
c) Generate new offspring with one-point crossover in the middle, randomly do mutation (change value) in two offspring
d) Compute the fitness of the new generation Use elitism to select 50% 1st generation chromosomes to replace 50%
chromosomes of 2nd generation to make the new population
e) Make a verdict to the overall fitness of the new population

2 Color the following map with forward checking algorithm Show the steps **10**



Do you think there is any other algorithm faster than forward checking? If yes, show how the algorithm works?

3 **10**

max

min

max

min

3 1 1 5 1 1 0 2 7 3 2 4

Perform Minimax algorithm on the figure with alpha-beta pruning

Term Test#01 Course Code—CSE 337 (AI) Date—October 27, 2022
Time—30 Minutes Set—2011 Total Marks#20

(You must answer all the questions)

1. (a) Define **Rational Agent** and **Limited Rationality**. 2

   (b) Compare **Computer** and **Human Brain** with respect to **Cycle Time**, and **Operation/sec**. 4

   (c) Write on two **state of the art** AI systems. $2 \times 2 = 4$

2. (a) Write the **PEAS** description for a **Robot Soccer Player**. 2

   (b) What is **simple reflex agent**? Sketch its diagram and explain it. $1 + 2 + 1 = 4$

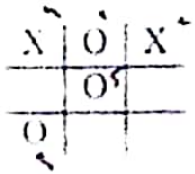
3. What is **admissible heuristic**? "The cost of an optimal solution to a relaxed problem is an admissible heuristic for the original problem" — Explain. 4

-End-

Term Test#02 Course Code--CSE 337 (AI) Date—December 18, 2022
Time--30 Minutes Set--2029 Total Marks#20

(You must answer all the questions)

1. Consider the following half-played 3 × 3 tic-tac-toe game. Here, O is your (Player 1) symbol and X is your opponent's (Player 2) symbol. Here, you played first and you have just given your 3rd move.



Now, answer the following questions sequentially.

(a) Draw the rest of the game tree considering the above state as root. No need to go further if one player wins. 7

(b) How many terminal nodes are generated? Why is not it equal to 4!? 1 + 1

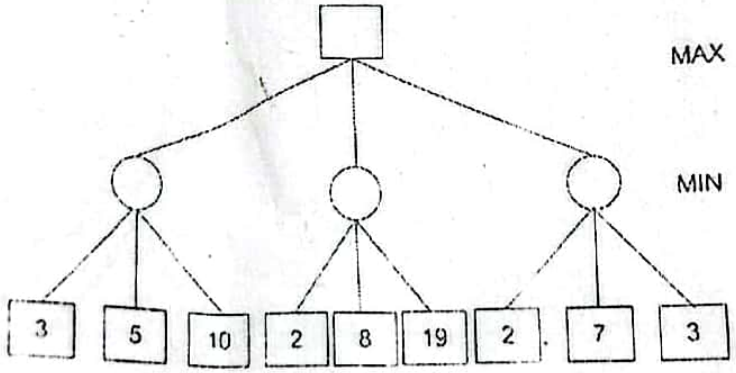
(c) Apply minimax algorithm on the generated game tree (Utility function for player 1: win = 1, lose = -1, draw = 0). 5

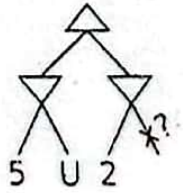
(d) Draw the best possible moves of player 1. Is it a win, lose or draw? 2

2. Sketch a graph to visualize the following terms: Shoulder, Global Maximum, Local Maximum, Flat Local Maximum. 4

-End-

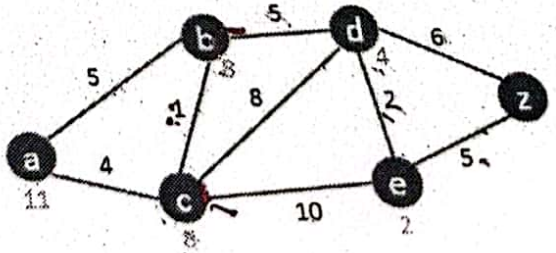
#CSE433 #TT02 #CSESUST

Q1	(a) Define the Constraint Satisfaction Problems. Describe the elements in the definition. (b) Use an example to define the map colouring problem as a Constraint Satisfaction Problem	10
Q2	Simulate the algorithm MINIMAX to explore the following game tree, searching from left to right. Show the alfa cutoffs and the beta cutoffs wherever they take place. Also mark the path the game is likely to take. What is the minimax value of the game tree? 	10

Consider the game tree shown below. For what range of U will the indicated Pruning take place? What will be the value of the root node?	

#CSESUST #CSE433 #TT01 | Marks: 40 | Time: 40 mins

Q1	Define: (a) intelligence, (b) artificial intelligence, (c) agent, (d) rationality, (e) logical reasoning	10
Q2	For each of the following assertions, say whether it is true or false and support your answer with examples or counterexamples where appropriate. (k) An agent that senses only partial information about the state cannot be perfectly rational. (l) There exist task environments in which no pure reflex agent can behave rationally. (m) There exists a task environment in which every agent is rational. (n) The input to an agent program is the same as the input to the agent function. (o) Every agent function is implementable by some program/machine combination. (p) Suppose an agent selects its action uniformly at random from the set of possible actions. (q) There exists a deterministic task environment in which this agent is rational. (r) It is possible for a given agent to be perfectly rational in two distinct task environments. (s) Every agent is rational in an unobservable environment. (t) A perfectly rational poker-playing agent never loses.	10
Q2	Answer any **two** questions. (c) What is Agent Function? Describe the agent function of agent vacuum cleaner (Four Tiles A, B, C and D). How can you measure its performance? (d) What are the characteristics of the task Environment "LUDO Game"?	
Q3	Consider the search space below where **"a"** is the starting state and **"z"** satisfies the goal test. Show the steps if we want to find **"z"** using A* Search algorithm. (Arcs are labeled with the cost of traversing them and the estimated cost to reach the goal is reported beside each node).	



Group B

[Answer all the questions]

2*5=

Q4 Answer any **Five** questions

(a) Sudoku is a CSP problem, true or false. If true write its components.
(b) What is game tree?
(c) Differentiate between informed and un-informed search.
(d) What do you mean by Turing test?
(e) What do you mean by rational agent?
(f) What do you know about adversarial search?
(g) What do you understand by Knowledge Base?
(h) Define pragmatics and discourse analysis.

5*4=

Q5 Answer any **Four** questions

(a) Define in your own words: (i) intelligence, (ii) artificial intelligence, (iii) agent, (iv) rationality, (v) logical reasoning.
(b) What is Completeness and Optimality of an Algorithm? Why is Greedy Best First Search Not Complete? Explain with an example.
(c) Translate the following into good, natural English (no xs or ys!):
$\forall x, y, l\ SpeaksLanguage(x, l) \wedge SpeaksLanguage(y, l)$
$\Rightarrow Understands(x, y) \wedge Understands(y, x)$
(d) What is a heuristic? Design and heuristic function and solve the given 8-puzzle.

1	2	3
8	5	6
4	7	

Initial State

1	2	3
4	5	6
7	8	

Goal State

(e) Why A* Search Algorithm is Optimal?
(f) What do you mean by Planning? Write some practical applications of planning.

10*2=

Q6 Answer any **Two** questions.

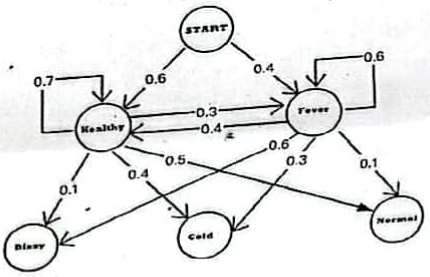


Figure 1

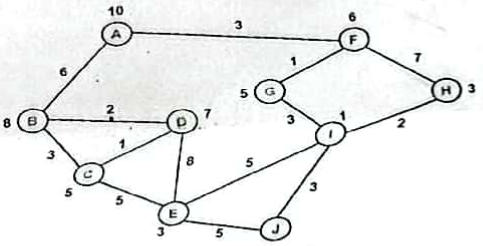
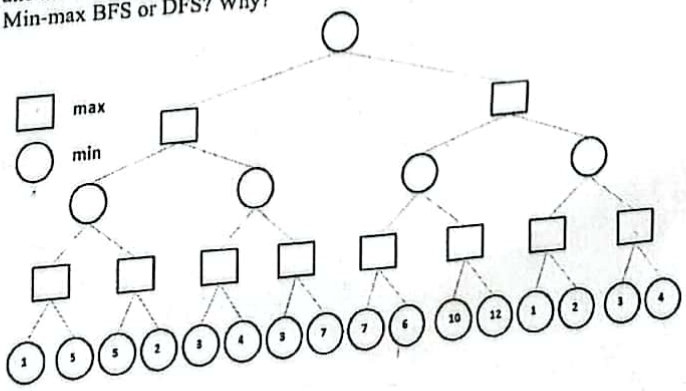


Figure 2

(a) Consider State Machine Diagram on Figure 1 and find the hidden states for the given observation "Normal", "Dizzy" ,"Dizzy" using HMM.
(b) Consider the graph on figure 2. The numbers on the edges represent the distance between the nodes and the numbers on the nodes represent the heuristic value. Find the most cost-effective path to reach from start state A to final state J using A* algorithm.
(c) Answer the following questions:
  (i) Using Min-max approach, fill up the blank nodes in the given game tree with appropriate values.
  (ii) Prune the tree using alpha-beta cutoffs.
  (iii) Is Min-max BFS or DFS? Why?



Shahjalal University of Science and Technology

Department of Computer Science and Engineering

4th Year 1st Semester Final Examination' 2021 (Session: 2017-18)

Course Code: CSE 433 Credits: 3 Course Title: Artificial Intelligence

Time: 3 hrs **Total Marks: 100**

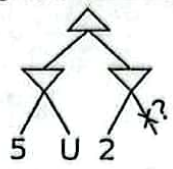
Group A

[Answer all the questions]

1 Answer any **Five** questions

(a) What is best first search?

(b) Consider the game tree shown below (on the right). For what range of U will the indicated pruning take place?



(c) What do you mean by Inference Engine?

(d) Give 3 real-world applications of AI.

(e) What do you mean by branching factor?

(f) What is combinatorial explosion?

(g) What do you mean by Node Consistency and Arc Consistency?

(h) The running time of Alpha-Beta is independent of the ordering of the leaves of the game tree. - T/F? Why?

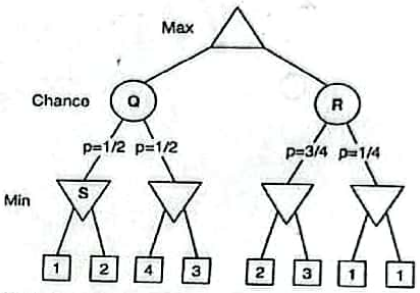
2 Answer any **Four** questions

(a) Briefly discuss about the structure of an Agent. What do you mean by a Knowledge Based agent? Mention it's properties.

(b) Figure on right shows the game tree of a two-player game; the first player is the maximizer, and the second player is the minimizer. Use the tree to answer the following questions:

i) What is the value of the node labeled S, Q and R?

ii) What is the expected value of the game?



(c) What do you mean by Constraints? What are Unary, Binary and Higher Order Constraints? Explain with example(s).

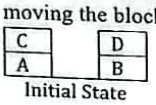
(d) Explain why it is a good heuristic to choose the variable that is most constrained but the value that is least constraining in a CSP search.

(e) How can we solve a CSP? When doing backtracking with forward-checking, do we need to check the consistency of a new assignment with previous assignments? Explain Why?

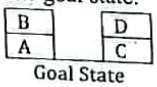
(f) Write on the four ways to measure problem-solving performance.

3 Answer any **Two** questions.

(a) What are the assumptions of a block world environment? Suppose a robot hand can perform the following four actions: UNSTACK(x, y), STACK(x, y), PICKUP(x) and PUTDOWND(x). Find the solution for moving the blocks from the given initial state to the goal state.

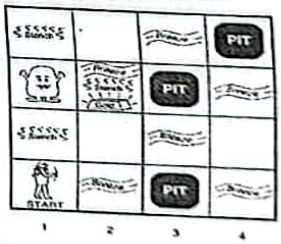


Initial State



Goal State

(b) Consider the agent of Wumpus World on the right. Discuss the characteristics of the Task Environment and PEAS Description. Illustrate how the agent will find its goal by applying logical reasoning.



(c) You are in charge of scheduling for computer science classes that meet Mondays, Wednesdays and Fridays. There are 5 classes that meet on these days and 3 professors who will be teaching these classes. You are constrained by the fact that each professor can only teach one class at a time. The classes are:

- Class 1 - Intro to Programming: meets from 8:00-9:00am
- Class 2 - Intro to Artificial Intelligence: meets from 8:30-9:30am
- Class 3 - Natural Language Processing: meets from 9:00-10:00am
- Class 4 - Computer Vision: meets from 9:00-10:00am
- Class 5 - Machine Learning: meets from 9:30-10:30am

The professors are:

- Professor A, who is available to teach Classes 3 and 4.
- Professor B, who is available to teach Classes 2, 3, 4, and 5.
- Professor C, who is available to teach Classes 1, 2, 3, 4, 5.

Formulate this problem as a CSP problem in which there is one variable per class, stating the domains, and constraints. Constraints should be specified formally and precisely but may be implicit rather than explicit. Draw the constraint graph associated with your CSP.

Group - B

4. Answer any five. **1*5**

a) What is Control Strategy?
b) What does Pragmatic analysis do?
c) Give two example of Constraint Satisfaction problem.
d) What is the brittleness problem in traditional expert systems?
e) When a function is called a Heuristic function?
f) What is combinatorial explosion?
g) Which one is better in terms of memory requirement, BFS or DFS?

5. Answer any four. **2.5*4**

a) Make a grammar for the structure of English affirmative sentences.
b) Draw the parse tree for the following sentence according to the grammar you made in the previous question.

A diamond is a lump of coal that did well under pressure.

c) How does *Alpha-Beta Cutoff(s)* refine Minimax algorithm?
d) Convert followings to corresponding English sentence.

I. $\forall x$: Pompeian(x) $\rightarrow$ Roman(x)
II. $\forall x$: Roman(x) $\rightarrow$ loyalto(x, Caesar) $\vee$ hate(x, Caesar)
III. $\forall x$: (Mushroom(x) $\wedge$ purple(x)) $\rightarrow$ poisonous(x)
IV. $\forall x$: $\exists y$: loyalto(x, y)
V. $\forall x$: Gardener(x) $\rightarrow$ likes(x,Sun)

e) What are the major steps of Natural Language Processing?
f) What is the difference between Syntactic analysis and Morphologicalanalysis?

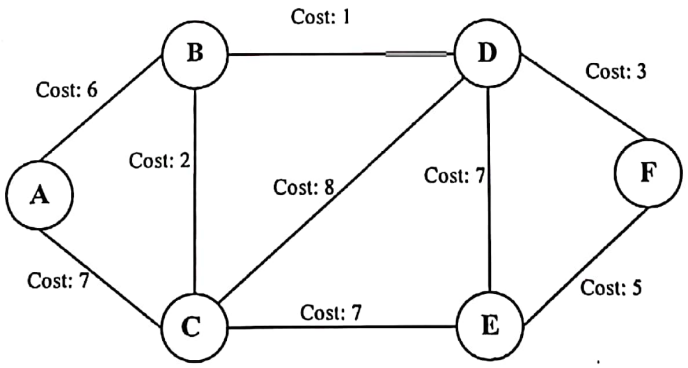
6. Answer any two. **5*2**

a) Assume the following axioms facts:

i. X is a student.
ii. X likes interesting classes.
iii. X doesn't attend boring classes.
iv. AI classes were boring.
v. Attended means present.

Use resolution to answer the question, "Was X present in AI classes?"

b) Solve the following travelling problem using any heuristic search technique. Mark the steps to the solution. **Start: A** and **Destination: E [The solution must be both cost and time effective]**



c) For which purpose Universal and Existential quantifiers are used? Explain Computable function and Unification in predicate logic.

ShahJalal University of Science and Technology

Department of Computer Science & Engineering
Semester Final Examination2020
4th Year 1st Semester, Session: 2016-17
Course Title: Artificial Intelligence
Course No. **CSE 433**; Credit: 03

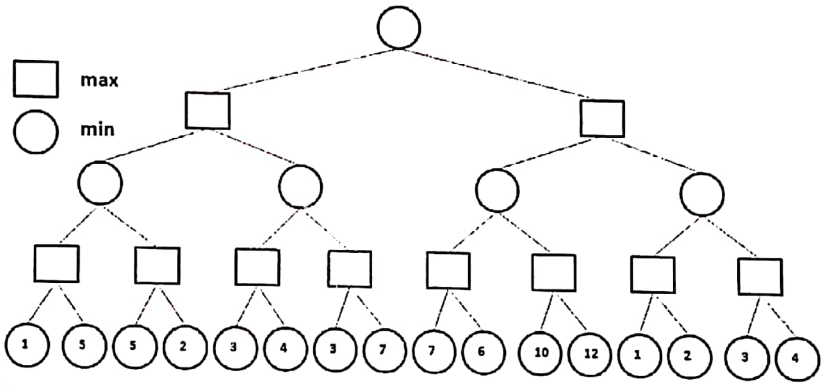
Time: 2:00 Hours **Full Marks: 50**

(Answer all the questions)

Group - A

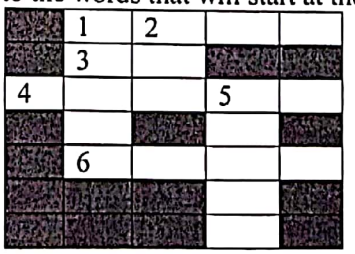
1. Determine whether the following statements are True or False. If False, give the Correct Answer.**Answer any five.** **1*5**
   a) Game playing is the most structured task in the field of Artificial Intelligence.
   b) Absence of Meta data makes expert system more prone to brittleness.
   c) AND-OR graphs are used to decompose a problem into a set of smaller problems.
   d) The goal of syntactic analysis is Parsing.
   e) Branch and Bound can beat Combinatorial Explosion.
   f) A plateau refers to a state that is better than its all neighboring states.
   g) In Morphological analysis, sequence of words is analyzed.

2. **Answer any four.** **2.5*4**
   a) How Best-first search combines BFS with DFS?



   b) Fill in the blank boxes with the appropriate numbers using min-max algorithm.
   c) How Steepest Ascent Hill Climbing is different than Simple Hill Climbing approach?
   d) What are the major problems of traditional expert systems?
   e) How expert systems gather useful knowledge to its knowledge base?
   f) Write down the basic algorithm for simple Generate-and-Test search.

3. **Answer any two.** **5*2**
   a) Show alpha-beta cutoff in the game tree mentioned in 2(a).
   b) Automated Medical Diagnosis System is an Expert System – Justify this statement.
   c) Do you think crossword puzzle is can be solved through constraint satisfaction mechanism? If yes, then list down all the constraint to be satisfied to solve the following crossword puzzle. If no, then explain your opinion. [The numbers 1, 2, 3, 4, 5, 6 in the crossword puzzle correspond to the words that will start at those locations.]



Group B

[Answer all the questions]

4. **Answer any FIVE** 5x2=10

a) When we use AND-OR graph to solve a problem? State in brief with example.

b) If P is true and Q is true, then are the followings are True or False?
- $P \rightarrow Q$
- $(P \vee Q) \rightarrow Q$

c) Convert the following sentences into formulas in First Order Logic and Corresponding Clausal form.
- Every People like some Foods.
- Some Costly Foods of KFC are not Delicious.

d) What is the difference between Neural Networks and Multilayer Perceptron?

e) What exactly is deep learning?

f) What do you mean by Planning? Write some practical applications of planning.

g) What is turing test?

h) What do you mean by an Expert System?

5. **Answer any FOUR** 4x5=20

a) Assume, you have to complete the following crossword puzzle through constraint satisfaction mechanism. Given the list of words: AT, ETA, BE, HAT, HE, HER, IT, HI, ON ,ONE, DESK, DANCE, USAGE, EASY, DOVE, FIRST, ELSE, LOSES, FUELS, HELP, HASTE, KIND, SOON, SOUND, THIS, THINK. 5

The numbers 1, 2, 3, 4, 5, 6 in the crossword puzzle correspond to the words that will start at those locations.

Now Formulate the constraints to be satisfied for the above problem.

b) Briefly describe the structure of an Agent. What is a Learning Agent? 5

c) What is adversarial search? What is Unary, Binary and Higher Order Constraints? Explain with examples. 5

d) What do you mean by Supervised Learning, Unsupervised Learning and Reinforcement Learning? Explain with some examples. 5

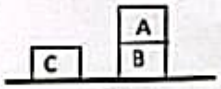
e) "When using alpha-beta pruning, the computational savings are independent of the order in which children are expanded."-True/False? Explain with example(s). 5

f) What is Completeness and Optimality of an Algorithm? Why is Greedy Best First Search Not Complete? Explain with an example. 5

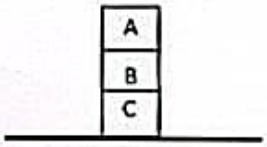
6. **Answer any TWO** 2x10=20

a) Solve the following block world problem using goal stack planning. Describe Start and Goal State. Write actions and their Preconditions. 10

[Hints:
Action Given:
Move(x, y),
MoveToTable(x)]

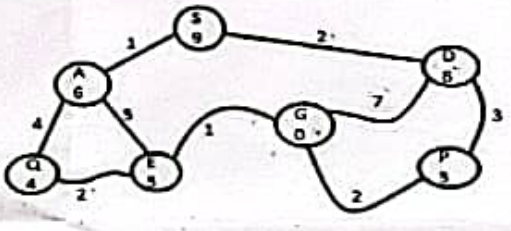


Initial State



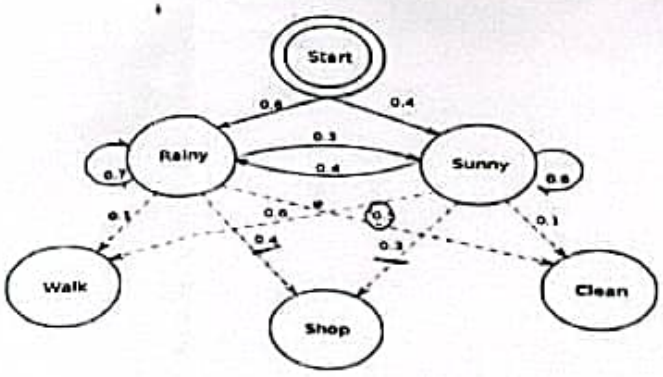
Goal State

b) Consider the search space on right where S is the starting state and G satisfies the goal test. Show the steps if we want to find G using A* Search algorithm. (Arcs are labelled with the cost of traversing them and the estimated cost to reach goal is reported inside nodes). 10



c) What are the differences between Propositional Logic and FOL?

Consider the following State Machine Diagram and find the hidden states for the given observation "Walk", "Shop", "Clean" using HMM. 10



Shahjalal University of Science and Technology
Department of Computer Science and Engineering
4th Year 1st Semester Final Examination' June 2019 (Session: 2015-16)

Course Code: CSE 433 | Credits: 3 | Course Title: Artificial Intelligence
Time: 3 hrs | Total Marks: 100

Group A

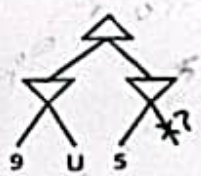
[Answer all the questions]

1. **Answer any FIVE** 5x2=10

a) Write the rules for modus ponens. What is adversarial search?
b) What is Unary, Binary and Higher Order Constraints?
c) What are the characteristics of the task Environment "LUDU Game"?
d) How can you formulate 8-puzzle Game problem?
e) Define Rationality and Intelligent Agent. What is Agent Function?
f) Write down 5 fields where AI is widely used.
g) What is a Perceptron?
h) How does Best First Search combine BFS and DFS?

2. **Answer any FOUR** 4x5=20

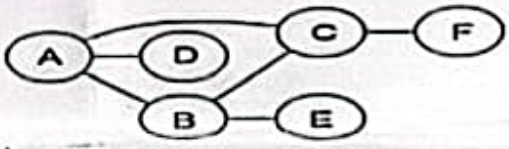
a) What is Artificial Neural Network? How do Neural Network Work/Learn? 5
b) "When using alpha-beta pruning, the computational savings are independent of the order in which children are expanded." – True / False? Why? 5
c) What is the meaning of h(n)? Why A* Search Algorithm is Optimal? 5
d) Consider the game tree shown right. For what range of U will the indicated pruning take place? What will be the value of the root node? Why? 5



e) The graph below is a constraint graph for a CSP that has only binary constraints. Initially, no variables have been assigned. For each of the following scenarios, mark all variables for which the specified filtering might result in their domain being changed.

A value is assigned to A. Which domains might be changed as a result of running forward checking for A? 5

A value is assigned to A, and then forward checking is run for A. Then a value is assigned to B. Which domains might be changed as a result of running forward checking for B?



f) Convert following to corresponding English sentence. 5

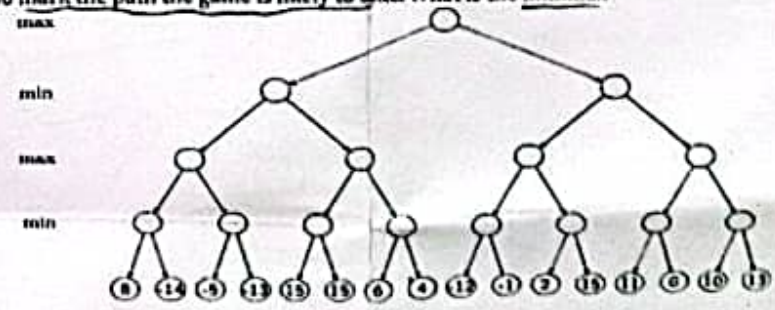
I. $(\forall x)(\exists y)$ likes(x,y)
II. $\forall x$ gardener(x) → likes(x,Sun)
III. $\forall x$ (mushroom(x) ∧ purple(x)) → poisonous(x)
IV. $\exists x \forall t$ person(x) ∧ time(t) → can-fool(x, t)

3. **Answer any TWO** 2x10=20

a) What is game tree? Consider the following states of 8 puzzle game. Construct the game tree. Show the moves to solve the puzzle using any heuristic. 10

1	2	3
5		8
4	6	7

b) Simulate the algorithm Alfa-Beta to explore the following game tree, searching from left to right. Show the alfa cutoffs and the beta cutoffs wherever they take place. Also mark the path the game is likely to take. What is the minimax value of the game tree? 10



c) Assume the following axioms facts:

i. X is a student.	vi. X likes interesting classes.
ii. X studies in CSE department.	vii. X doesn't attend boring classes.
iii. X has passed HSC in the year 2013.	viii. AI classes were boring.
iv. Passing year is session.	ix. Attended means present.
v. The students of 2013 session of CSE department are awesome.	

1. Use resolution to prove the statement, "X is awesome." 5
2. Use resolution to answer the question, "Was X present in AI classes?" 5