DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UNIVERSITY OF BARISHAL
FINAL EXAMINATION-2020
Course Title: Artificial Intelligence
Course Code: CSE-3205
3rd Year 1st Semester
Session: 2017-18

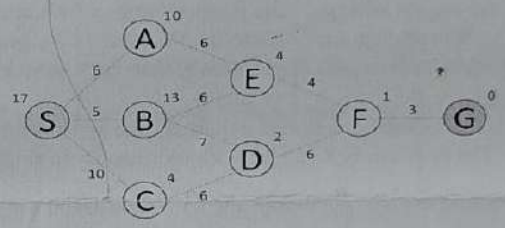
Time: 3 hours **Marks:** 60

Answer any five Questions from the followings.

1. a) The Task Environment for a **Virtual English Tutor** must have Performance, Environment, Actuators, and Sensors. By considering these four parameters develop the **PEAS** descriptions for a **Virtual English Tutor** Agent. [3]
   b) Define Agent and Rational Agent through real-time example [3]
   c) Distinguish between the following properties of a task environment: [3]
      i. Static or dynamic ii. Discrete or continuous iii. Single or multi-agent
   d) Briefly explain the PEAS description of the task environment for **an automated taxi.** [3]

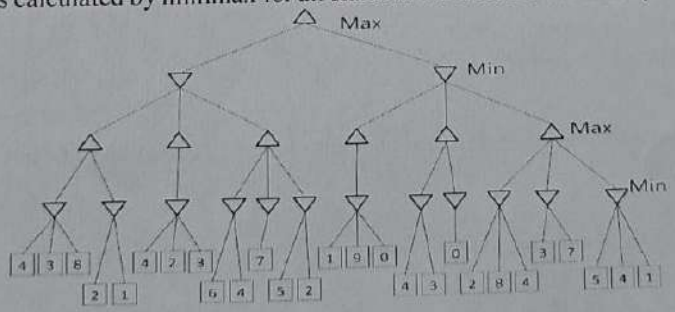
2. a) List the criteria to measure the performance of different search strategies. [3]
   b) Differentiate Uninformed Search (Blind search) and Informed Search (Heuristic Search) strategies. [3]
   c) Prove that the time and space complexity of BFS is $O(b^d)$. And explain it with an example [4]
   d) Does artificial intelligence provide an alternative to the biological substances? [2]

3. a) Prove that A* search is optimal if h(n) is admissible. [3]
   b) Perform A* Algorithm on the following figure. Explicitly write down the queue at each step [5]



   c) A hypothetical state space with heuristic evaluation is given as: [4]
   ROOT: A-5
   LEVEL 1: B-4, C-4, D-6
   LEVEL2: E-5, F-5, G-4, H-3, I, J
   LEVEL3: K, L, M, N, O-2, P-3, Q-3, R
   LEVEL4: S, T, U, V
   If P is the goal state, how do you reach the goal state using best-first search?

4. a) Give the values calculated by minimax for all states in the tree. Do not use alpha-beta pruning [5]



   b) Indicate which branches of the tree will be pruned by alpha-beta pruning? [4]
   c) Abduction is an inference rule that infers P from P→Q and Q. show that abduction is not sound. [3]

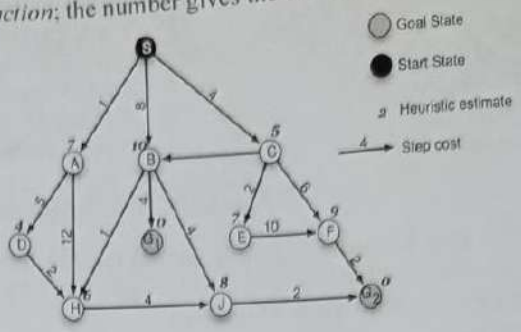
5. a) You are planning to purchase motorcycle. You look for a particular mode from three dealers. The probabilities of visiting a dealer and making a purchase are given in the following table. What is the probability that you buy the motorcycle from dealer D3? [4]

Dealer	Visiting (%)	Purchase (%)
D1	0.2	0.4
D2	0.3	0.4
D3	0.5	0.2

b) Consider the search space below, where S is the start node and G1 and G2 are goal nodes. [2*4]
Arcs are labeled with the value of a *cost function*; the number gives the cost of traversing the arc. Above each node is the value of a *heuristic function*; the number gives the estimate of the distance to the goal. Assume that the algorithms do *not* keep track of and recognize repeated states.
For each of the following search strategies,

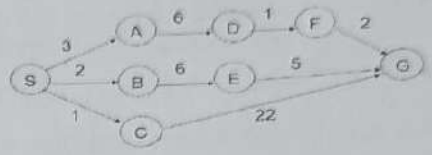
BFS, DFS, GBFS

i. indicate which goal state is reached first (if any) and
ii. List *in order*, all the states that are popped off the OPEN list.



[5]

6. a) The graph above shows the step costs for different paths going from the start (S) to the goal (G). Use uniform cost search to find the optimal path to the goal.



b) What is natural language processing (NLP)? Describe the development steps for a typical NLP application. [3]

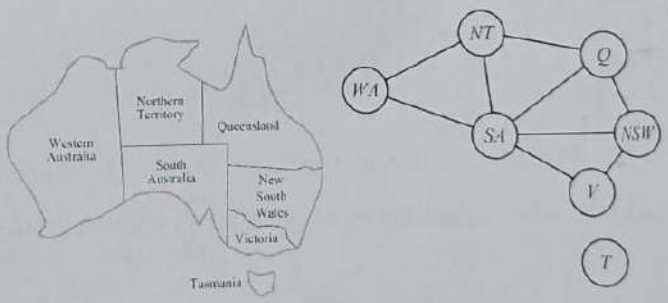
c) Consider the unreal car diagnosis rule based expert system with the following rules: [4]

Rule 1	Rule 2	Rule 3	Rule 4
If the engine is getting gas, and the engine will turn over, then the problem is spark plugs.	If the engine does not turn over, and the lights do not come on, then the problem is battery or cables.	If the engine does not turn over, and the lights do not come on, then the problem is the starter motor.	If there is gas in the fuel tank, and there is gas in the carburetor, then the engine is getting gas.

How does the mentioned expert system apply goal-driven reasoning with preliminary goal "The problem is X" in its working memory to find out the problem of the car.

7. a) Define in your own words the terms constraint satisfaction problem, constraint, backtracking search, and arc consistency. [3]

b) Coloring this map can be viewed as a constraint satisfaction problem. The goal is to assign colors to each region so that no neighboring regions have the same color with the color of red, green, and blue only. How many solutions are there for the map-coloring problem in the following figure? [5]



c) Benefits of Arc consistency over forward checking for early detection of failure. Explain with a proper example. [4]

8. a) Translate each of the following sentences into First Order Logic (FOL) [6]

I. Not all cars have carburetors
II. All babies are illogical
III. Every connected and circuit-free graph is a tree
IV. All that glitters is not gold
V. Not all that glitters is gold
VI. There is a barber who shaves all men in the town who do not shave themselve

b) Check the validity of the following implications [3*2]

I. $P \rightarrow (Q \rightarrow R)$ equivalent to $(P \rightarrow Q) \rightarrow (P \rightarrow R)$
II. $[(P \rightarrow Q) \vee (R \rightarrow S)] \rightarrow [(P \vee R) \rightarrow (Q \vee S)]$