a) Suppose you are going to develop an autonomous vehicle robot agent. The sole purpose of this car agent is to provide safe and driverless journey to humans.

- It must be able to see and interpret like human driver.
- It should be equipped with mechanical and electrical sensors to sense various objects during.
- Vehicle should have all self-governing accessories to provide safe journey.

By considering the above mentioned requirements, fill the table provided below to specify the PEAS description of task environment for autonomous vehicle robot agent.

Agent Type	Performance Measure	Environment	Actuators	Sensors
Autonomous vehicle	Safety, drive comfort	Roads,	Steering Paddles (accelerator) alarming bells	Camera, wave splitter

b) You have already studied various environment types for different intelligent agents. Fill the following table by specifying environment type for respective agents.

Task Environment	Observable Fully/Partially	Single/Multi Agent	Deterministic/ Stochastic	Episodic/ Sequential	Static/ Dynamic	Discrete/ Continuous
Part-Picking Robot	fully	Single	deterministic	Episodic	Static	Discrete
Medical Diagnosis	fully	Multi	deterministic	Sequential	dynamic	Continuous

Question No. 3 Uninformed Searches [2+8=10]

a) **Short Questions: [1+1=2]**

1. What is meant by search algorithm completeness? **(1)**

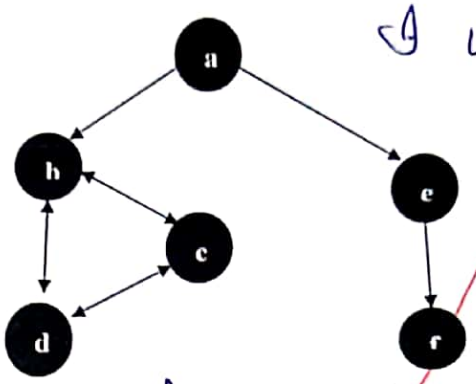
It means it gives you goal in a complete manner. eg Depth limit search is not complete.

2. What is meant by search algorithm optimality? **(1)**

It means that it gives you the desired goal the best solution of your goal.

b) DFS & BFS [4+4=8]

(i) Consider the search problem represented in Figure, where *a* is the start node and *f* is the goal node. Would you prefer DFS or BFS for this problem? Why? **(4)**



I would by DFS because saves your memory. O(bm)

loop between b, d, c

(ii) Which sequences of paths are explored by BFS and DFS in this problem? **(4)**

stack

DFS

(a)

(a,b) (a,e)

(a,b,d) (a,e)

(a,b,d,c) (a,e)

(a,e,f)

with Lithographic order

(a)

(a,e) (a,b)

(a,e,f)

Lithographic order

BFS

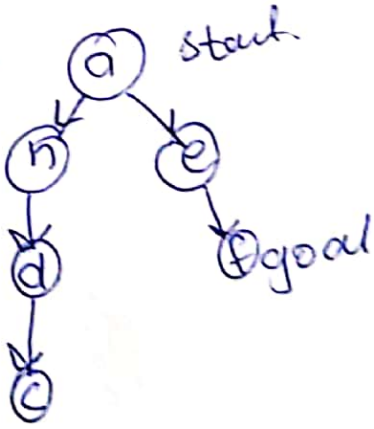
Queue

(a)

(a,e),(a,b) (a)

(a,e,f) ✓ goal

2

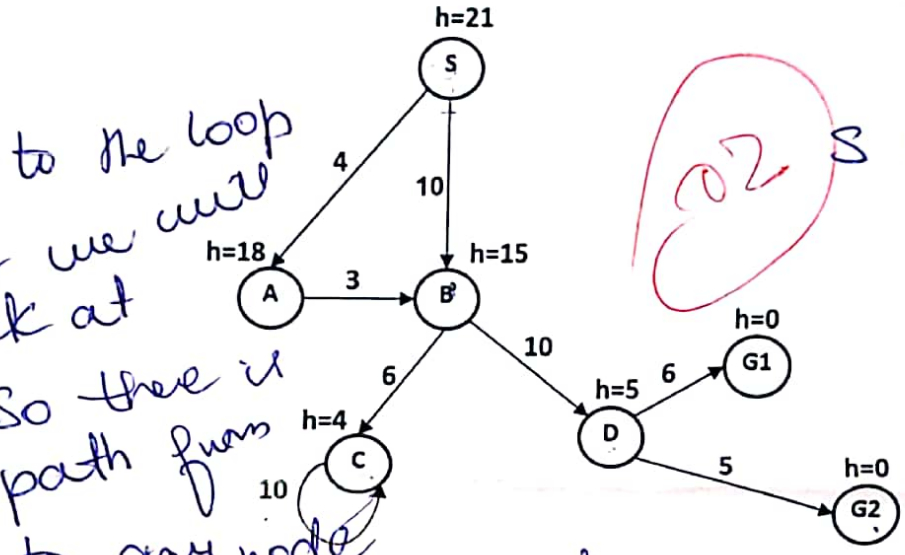


a - b - d - c - e

Question No. 4 State Space Search [3+3+3+3=12]

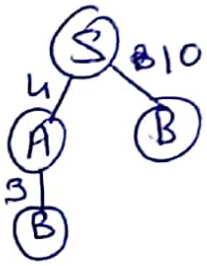
Consider the search problem given below with start state S and goal states **G1, G2**. The **transition costs** of the arcs are labelled upon the arcs, and the **heuristic values** are next to the states. Each goal state has heuristic value equal to zero. If a node has multiple successors, expand the successors in **alphabetic order** (For example, the successor nodes of S are A and B). The search is terminated as soon as **ANY** goal state (G1, G2) has been reached. Do not remember visited or expanded nodes so its mean loops are possible.

For each search strategy given as below, show the order in which nodes are **expanded (i.e. the children are generated)**, the **Final Path to goal** and the **Final Cost** up to the goal state.



due to the loop at C we will stuck at C. So there is no path from C to any node we will went to the direct D from B

G2 S A B



(i) **Uniform Cost Search** $(2 + \frac{1}{2} + \frac{1}{2})$

Order of Expansion: S → A → B → D → G2

Final Path to Goal: S → A → B → D → G2

Final Cost to the Path found: 22

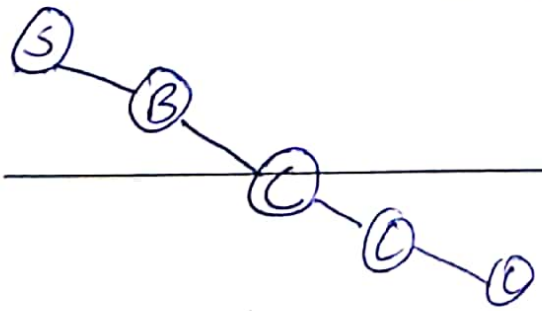
(SA)=4 SB(10) SAB=7 SBC

(ii) **Best First Search** $(2 + \frac{1}{2} + \frac{1}{2})$

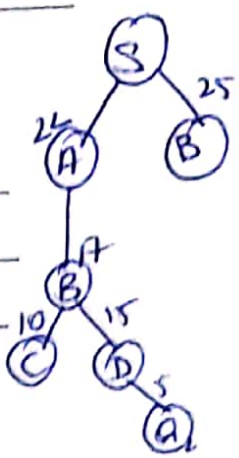
Order of Expansion: S → A → B → D → G1, G2

Final Path to Goal: S → A → B → D → G2

Final Cost to the Path found: 22



(SA,4) (SAB,7) (SABD,17) (SABDG2,22)



(iii) **A* Search** $(2 + \frac{1}{2} + \frac{1}{2})$

Order of Expansion: S → A → B → D → G2

Final Path to Goal: S → A → B → D → G2

Final Cost to the Path found: 22

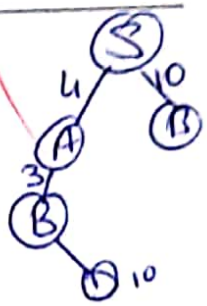
(iv) **Iterative Deepening Search** $(2 + \frac{1}{2} + \frac{1}{2})$

Order of Expansion: S → A → B → D → G2

Final Path to Goal: S → A → B → D → G2

Final Cost to the Path found: 22

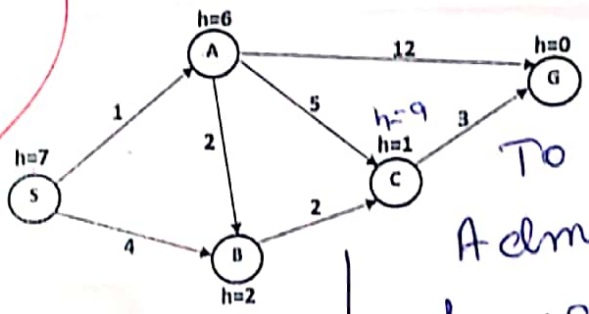
$h(n) \leq C(n)$



Question No. 5 Heuristics (4+4 = 8)

Consider the following graph and **prove that,**

(a) All heuristics are admissible. If not, make them admissible.
(b) All heuristics are consistent. If not, make them consistent.



To check consistent

$S \rightarrow A$

$h(B) \leq cost(A)$

$7 \leq 7$ consistent

$S \rightarrow B$

$7 \leq 6$ consistent

$S \rightarrow C$

$7 \leq 3$ not consistent

$S \rightarrow C \rightarrow$ Now consistent

$7 \leq 11$

shortest path

$S \rightarrow B \rightarrow C \rightarrow G$ = 9

To check. Admissible

at node C this is not consistent so just make it admissible

$h = 9$

$B \rightarrow C$

$h(B) \leq$ ~~cost~~ of C + path cost

$2 \leq 11$ admissible

$h(S) \leq C(S,n) + h(n)$