

# **UNIVERSITY OF ASIA PACIFIC**

Department of Computer Science and Engineering



**Course Title :**  
**Artificial Intelligence and Expert Systems**  
**Course Code : CSE 403**

**Assignment No: 01**

**Submitted By:**

**Sudip Ghose**

Section: B

ID: 18101094

**Submitted to:**

**Dr. Nasima Begum**

Assistant Professor

Department of CSE,

University Of Asia Pacific.

Problem: 1

Here,

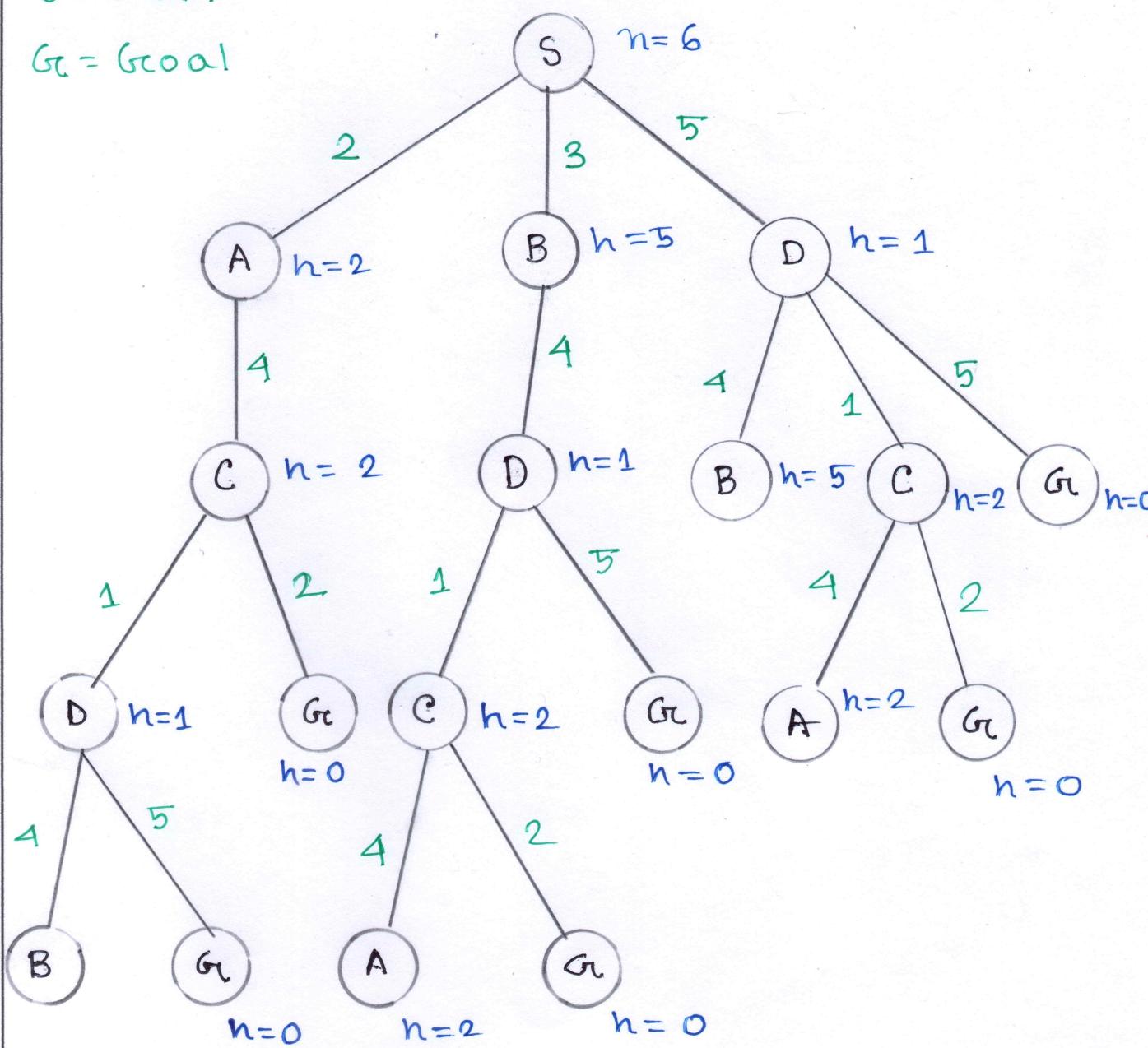
 $S = \text{Start}$  $G_C = \text{Goal}$ 

Fig. Search tree.

a) Depth-first Search:

States expanded	close-fringe	open-fringe
$S \rightarrow$	S	A, B, D
$S \rightarrow A$	S, A	B, D, C
$S \rightarrow A \rightarrow C$	S, A, C	B, D, D, G <sub>C</sub>
$S \rightarrow A \rightarrow C \rightarrow D$	S, A, C, D	B, D, G <sub>C</sub> , B, G <sub>C</sub>
$S \rightarrow A \rightarrow C \rightarrow D \rightarrow B$	S, A, C, D, B	B, D, G <sub>C</sub> , G <sub>C</sub>
$S \rightarrow A \rightarrow C \rightarrow D \rightarrow B \rightarrow D$	S, A, C, D, B	B, D, G <sub>C</sub> , G <sub>C</sub>
$S \rightarrow A \rightarrow C \rightarrow D \rightarrow B \rightarrow D \rightarrow G_C$	S, A, C, D, B, G <sub>C</sub>	B, D, G <sub>C</sub>

Path return:  $S \rightarrow A \rightarrow C \rightarrow D \rightarrow G_C$

b) Breadth-first search:

States expanded	close-fringe	open-fringe
S →	S	A, B, D
S → A	S, A	B, D, C
S → A → B	S, A, B	D, C, D
S → A → B → D	S, A, B, D	C, D, B, C, G <sub>C</sub>
S → A → B → D → C	S, A, B, D, C	D, B, C, G <sub>C</sub> , D, G <sub>C</sub>
S → A → B → D → C → D	S, A, B, D, C, D	B, C, G <sub>C</sub> , D, G <sub>C</sub> , C, G <sub>C</sub>
S → A → B → D → C → D → B	S, A, B, D, C, D, B	G <sub>C</sub> , D, G <sub>C</sub> , C, G <sub>C</sub> , A, G <sub>C</sub>
S → A → B → D → C → D → B → C	S, A, B, D, C, D, B, C	G <sub>C</sub> , D, G <sub>C</sub> , C, G <sub>C</sub> , A, G <sub>C</sub>
S → A → B → D → C → D → B → C → G	S, A, B, D, C, D, B, C, G <sub>C</sub>	D, G <sub>C</sub> , C, G <sub>C</sub> , A, G <sub>C</sub>

Path Return: S → D → G<sub>C</sub>

③ Uniform Cost Search:

States expanded	close-fringe	open-fringe
S	S	A, B, D
S → A	S, A	B, D, C
S → A → B	S, A, B	D, C, D
S → A → B → C	S, A, B, C	D, D, D, G <sub>C</sub>
S → A → B → C → D	S, A, B, C, D	D, D, G <sub>C</sub> , C, G <sub>C</sub>
S → A → B → C → D → C	S, A, B, C, D, C	
S → A → B → C → D → C → D		
S → A → B → C → D → C → D → G <sub>C</sub>		

Path return: S → A → C → G<sub>C</sub>

d) Greedy search with the heuristic  $h$  shown on the graph:

States expanded	close-fringe	open-fringe
S	S 6	A, B, D 2 5 1
S → D	S, D 6 1	A, B, B, C, Gc 2 5 5 2 0
S → D → Gc	S, D, Gc 6 1 0	A, B, B, C, C 2 5 5 2 2

Path return: S → D → Gc

e) A\* search with same heuristic:

States expanded	close-fringe	open-fringe
S	S 6	A, B, D 4 8 6
S → A	S, A 6 9	B, D, C 8 6 8
S → A → D	S, A, D 6 4 6	B, C, B, C, G <sub>C</sub> 8 8 14 8 10
S → A → D → B	S, A, D, B 6 4 6 8	C, B, C, G <sub>C</sub> , D 8 14 8 10 8
S → A → D → B → C	S, A, D, B, C 6 4 6 8 8	B, C, G <sub>C</sub> , D, D, G <sub>C</sub> 14 8 10 8 8 8
S → A → D → B → C → C	S, A, D, B, C, C 6 4 6 8 8 8	B, G <sub>C</sub> , D, D, G <sub>C</sub> 14, 10, 8, 8, 8, 8
S → A → D → B → C → C → D	S, A, D, B, C, C, D 6 4 6 8 8 8 8	B, G <sub>C</sub> , D, G <sub>C</sub> , A, G <sub>C</sub> 14, 10, 8, 8, 14, 10, 10
S → A → D → B → C → C → D → D	S, A, D, B, C, C, D, D 6 4 6 8 8 8 8 8	B, G <sub>C</sub> , G <sub>C</sub> , A, G <sub>C</sub> , B, G <sub>C</sub> 14, 10, 8, 8, 14, 10, 16, 12
S → A → D → B → C → C → D → D → G <sub>C</sub>	S, A, D, B, C, C, D, D, G <sub>C</sub> 6 4 6 8 8 8 8 8 8	B, G <sub>C</sub> , A, G <sub>C</sub> , B, G <sub>C</sub> 14 10 14 10 16 12

Path return : S → A → C → G<sub>C</sub>

Problem: 2

Here,

S = Start

Gr = Goal

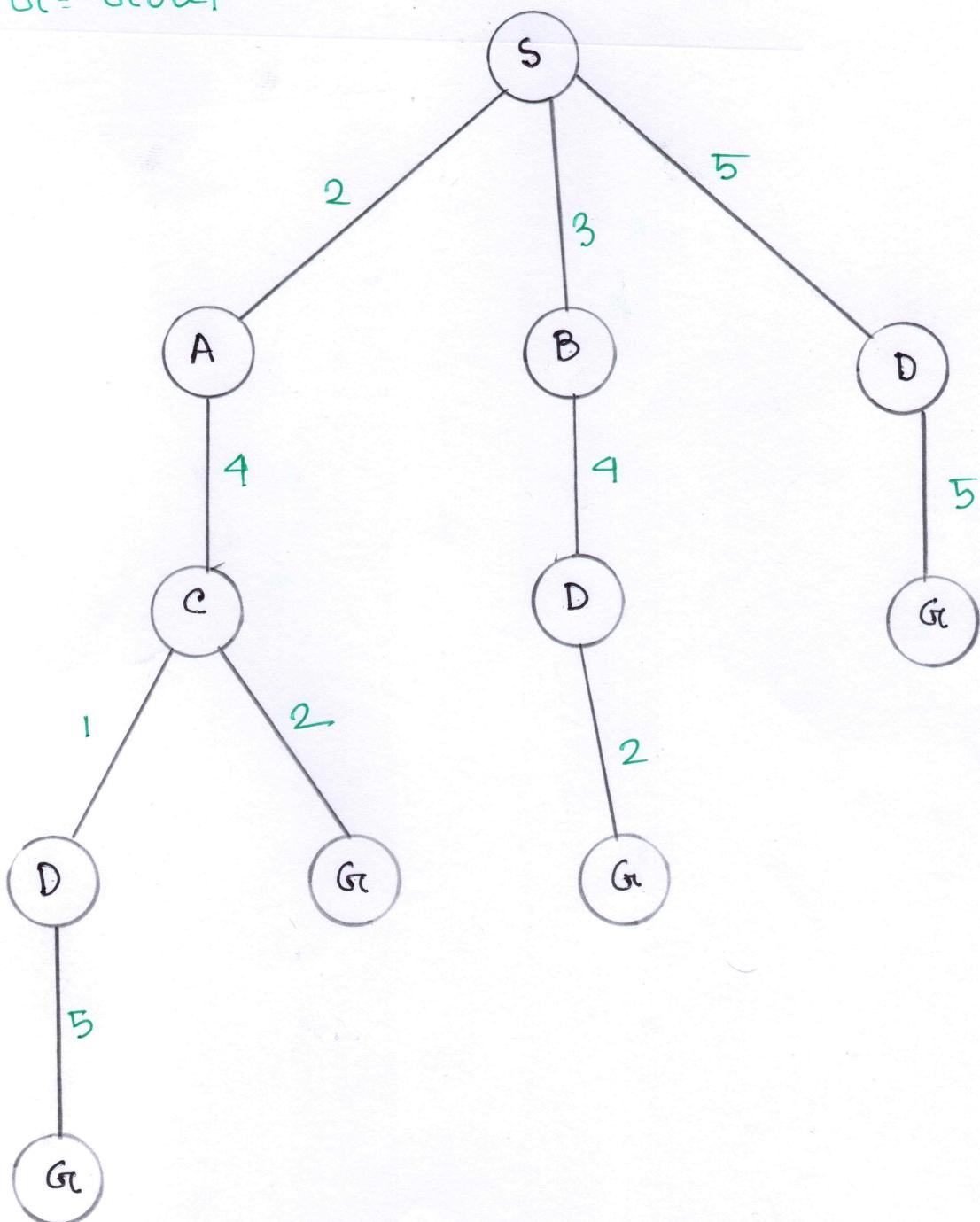


Fig. Search Tree.

a) Depth-first search:

---

states expended	close-fringe	open-fringe
S	S	A, B, D
S → A	S, A	B, D, C
S → A → C	S, A, C	B, D, D, GC
S → A → C → D	S, A, C, D	B, D, GC, GC
S → A → C → D → GC	S, A, C, D, GC	B, D, GC

Path return: S → A → C → D → GC

b) Breadth-First Search:

States Expanded	close-fringe	open-fringe
S	S	A, B, D
S → A	S, A	B, D, C
S → A → B	S, A, B	D, C, D
S → A → B → D	S, A, B, D	C, D, G <sub>C</sub>
S → A → B → D → C	S, A, B, D, C	D, G <sub>C</sub> , D, G <sub>C</sub>
S → A → B → D → C → D	S, A, B, D, C, D	G <sub>C</sub> , D, G <sub>C</sub> , G <sub>C</sub>
S → A → B → D → C → D → G <sub>C</sub>	S, A, B, D, C, D	D, G <sub>C</sub> , G <sub>C</sub>

Path return: S → D → G<sub>C</sub>

③ uniform cost search:

States Expanded	close-fringe	open-fringe
S	S	A, B, D
S → A	S, A	B, D, C
S → A → B	S, A, B	D, C, D
S → A → B → C	S, A, B, C	D, D, D, G <sub>L</sub>
S → A → B → C → D	S, A, B, C, D	D, D, G <sub>L</sub> , G <sub>R</sub>
S → A → B → C → D → G <sub>L</sub>	S, A, B, C, D, G <sub>L</sub>	D, D, G <sub>L</sub> , G <sub>R</sub>

Path return: S → A → C → G<sub>L</sub>