AI   Assignment 3
searching Strategies

Graph 1:
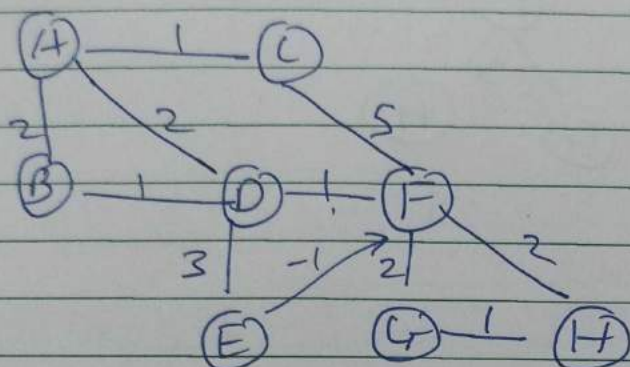
Graph 2:
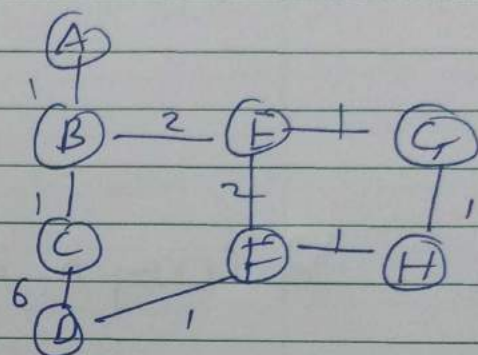
DFS:

Graph 1 :   Start = A   Goal = H

O L	N	C L	GT(N)	Succ(N)
A	A	A	F	B D C
B D C	B	A B	F	~~D~~ A
D C	D	A B D	F	E ~~F~~ A B
E F C	E	A B D E	F	~~F~~ D
F C	F	A B D E F	F	~~G~~ ~~H~~ ~~C~~ ~~D~~
G H C	G	A B D E F G	F	H F
H C	H	A B D E F G H	T	
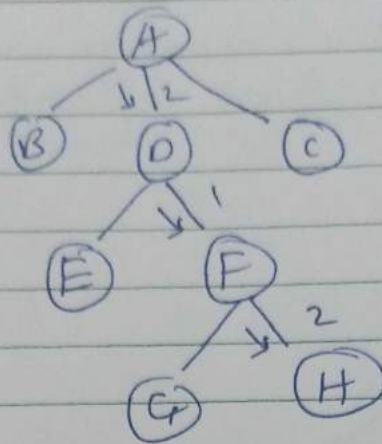
Path: A D F H
Cost: 5

Graph 2:

O L	N	C L	GT(N)	Succ(N)
A	A	A	F	B
B	B	A B	F	C E A
C E	C	A B C	F	D B
D E	D	A B C D	F	E C
F E	F	A B C D F	F	G H E
H E	H	A B C D F H	T	
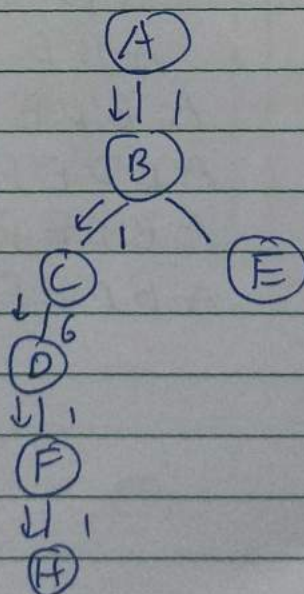
Path :- A B C D F H
Cost : 10

DFS is optimal for Graph I as minimum cost is 5 and DFS also gives 5. it is not optimal for Graph 2 as minimum cost is ~~6~~ 5 and it gives ~~2~~ 0

DFS is complete as it guarantees to find a solution.

ID-DFS :- Start = A   Goal = H

Graph I:
Depth 0:

OL	N	CL	GT(N)	Succ(N)
A	A	A	F	

H Not found.

Depth 1:

OL	N	CL	GT(N)	Succ(N)
A	A	A	F	B D C
B DC	B	AB	F	
DC	D	ABD	F	
C	C	ABDC	F	

H Not found.

Depth 2

O L	N	C L	GT(N)	Succ(N)
A	A	A	F	B D C
B D C	B	A B	F	D A
D A D C	D	A B D	F	
A D C	A	A B D A	F	
D C	D	A B D A D	F	E F A B
E F A B C	E	A B D A D E	F	
F A B C	F	A B D A D E F	F	
A B C	A	A B D A D E F A	F	
B C	B	A B D A D E F A B	F	
C	C	A B D A D E F A B C	F	F A
F A	F	A B D A D E F A B C F	F	
A	A	A B D A D E F A B C F A	F	

H Not found.

Depth 3 :

O L	N	C L	GT(N)	Succ(N)
A	A	A	F	B D C
B D C	B	A B	F	D A
D A D C	D	A B D	F	E F A B
E F A B A D C	E	A B D E	F	
F A B A D C	F	A B D E F	F	
A B A D C	A	A B D E F A	F	
B A D C	B	A B D E F A B	F	
A D C	A	A B D E F A B A	F	B D C
B D C D C	B	A B D E F A B A B	F	
D C D C	D	A B D E F A B A B D	F	
C D C	D	A B D E F A B A B D C	F	

O L	D	A BDEFABABDCD	F	EFAB
EFABC	E	A BDEFABABDCDE	F	FD
FDFABC	F	A BDEFABABDCDEF	F	
DFABC	D	HBDEFABABDCDEFD	F	
FABC	F	ABD EFABABDCDEFDF	F	GHCD
GHCDABC	G	ABDEFABABDCDEFDFG	F	
HCDABC	H	ABDEFABABDCDEFDFGH	T	
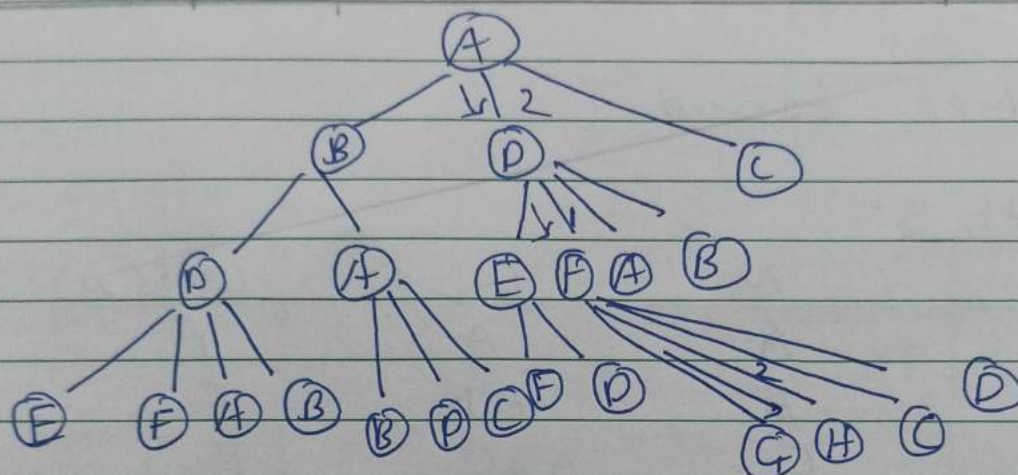
Path :: A D F H

Cost : 5

Graph 2 : Start = A   Goal = H

Depth 0 :

O L	N	G L	GT(N)	Succ(N)
A	A	A	F	

H Not found

Depth 1 :

O L	N	C L	GT(N)	Succ(N)
A	A	A	F	B
B	B	AB	F	

Depth 2:

OL	N	CL	GT(N)	Succ(N)
A	A	A	F	B
B	B	AB	F	CEA =F
CEA	C	ABC	F	
EA	E	A BCE	F	
A	A	A BCEA	F	

H Not found

Depth 3:

OL	N	CL	GT(N)	Succ(N)
A	A	A	F	B
B	B	AB	F	CEA
CEA	C	ABC	F	DB
DBEA	D	ABCD	F	
BEA	B	ABCDB	F	
EA	E	ABCDBE	F	FGB
FGBA	F	ABCDBEF	F	
GBA	G	ABCDBEFG	F	
BA	B	ABCDBEFGB	F	
A	A	ABABCDBEFGBA	F	B
B	B	ABBCDBEFGBAB	F	

H Not found

Depth 4 :

UN

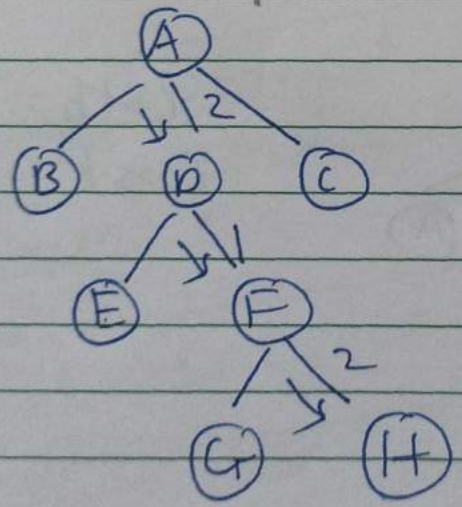| O L	N	C L	GT(N)	Succ(N)
A	A	A	F	B
B	B	A B	F	C E A
C E A	C	A B C	F	D B
D B E A	D	A B C D	F	F C	F(
F C B E A	F	A B C D F	F	
C B E A	C	A B C D F C	F	
B E A	B	A B C D F C B	F	C E A
C E A E A	C	A B C D F C B C	F	
E A E A	E	A B C D F C B C E	F	
A E A	A	A B C D F C B C E A	F	
E A	E	A B C D F C B C E A E	F	F G B
F G B A	F	A B C D F C B C E A E F	F	D H E
D H E G B A	D	A B C D F C B C E A E D	F	
H E G B A	H	A B C D F C B C E A E D H	T	
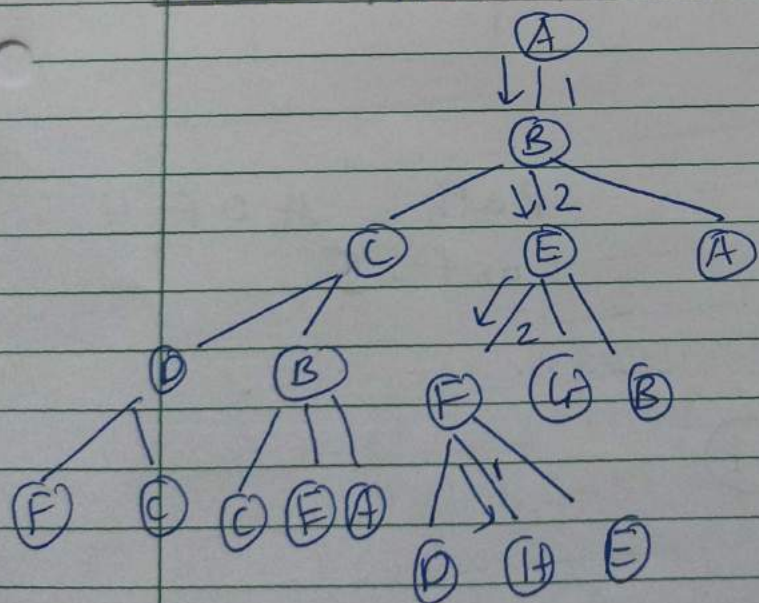
Path : A B E F H

Cost : 6

ID-DFS is optimal for Graph I
but not for graph 2
ID-DFS is not complete as
sometimes it may not find the
solution

BFS:

Graph 1: Start = A   Goal = H

OL	N	CL	GT(N)	Succ(N)
A	A	A	F	B D C
BDC	B	AB	F	DA
DC	D	ABD	F	EFAB
CEF	C	ABDC	F	FA
EF	E	ABDCE	F	FD
F	F	ABDCEF	F	GHCD
GH	G	ABDCEF	F	HF
A	H	ABDCEFH	T	

Path :- A D F H

Cost : 5

Graph 2 : Start = A   Goal = H

OL	N	CL	GTCNJ	Succ(N)
A	H	A	F	B
B	B	AB	F	CEA
CE	C	ABC	F	DB
ED	E	ABCE	F	FGB
DFG	D	ABCED	F	FC
FG	F	ABCEDF	F	DHE
GH	G	ABCEDFG	F	HE
H	H	ABCEDFGH	T	
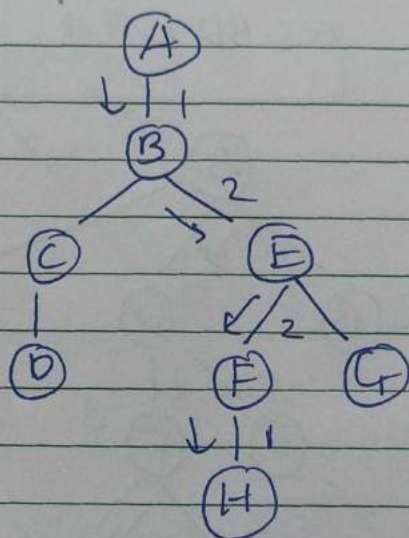
Path : ABEF H

Cost : 6

BFS is optimal for Graph 1, it is not optimal for Graph 2 as minimum cost is 5, but it gives 6
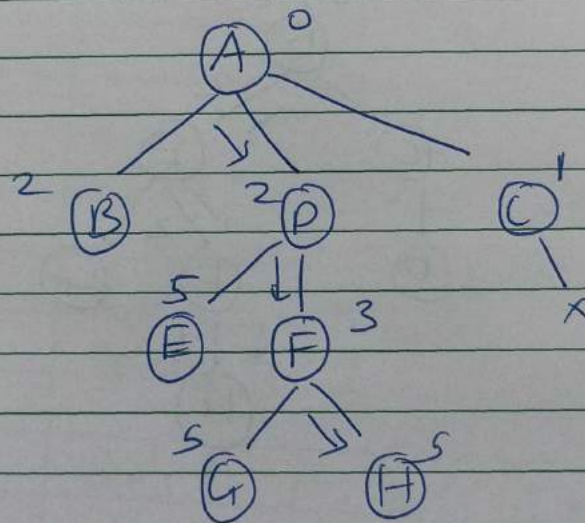
BFS is complete for both graphs

UCS: 5
Graph 1: start = A   Goal = H

OL	N	CL	GT(N)	Succ(N)
(A,0)	A	A	F	(B,2) (D,2) (C,1)
(C,1)(B,2)(D,2)	C	AC	F	(F,6) (A,2)
(B,2)(D,2)(E,6)	B	ACB	F	(D,3) (A,4)
(D,2)(F,6)	D	ACBD	F	(E,5)(F,3)(A,4)(B,3)
(E,5)(F,3)	E	ACBDE	F	(F,4) (D,8)
(F,3)	F	ACBDEF	F	(G,5)(H,5)(C,8)(D,5)
(G,5)(H,5)	G	ACBDEF	F	(H,6) (F,7)
(H,5)	H	ACBDEFH	T	

Path: ADFH
Cost: 5

Graph 2: start=A   Goal = H

A* search :

Graph 1 :

	h_1	h_2
A	6	3
B	6	3
C	7	2
D	6	2
E	7	2
F	2	1
G	2	1
H	0	0 .

Best First search : h_1

OL	N	CL	GT(N)	Succ(N)
(A,6)	A	A	F	(B,6)(D,6)(C,7)
(B,6)(D,6)(C,7)	B	AB	F	(D,6) (A,6)
(D,6) (C,7)	D	ABD	F	(E,7)(F,2)(A,6)(B,6)
(F,2)(C,7)(E,7)	F	ABDF	F	(G,2) (H,0) (C,7)(D,0)
(H,0) (G,2) (C,7)(E,7)	H	ABDFH	T	
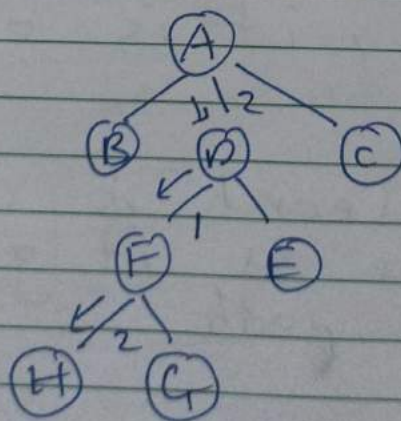
Path : A D F H

Cost : 5

∴ Best First Search optimal and complete

A* Search: h₁

O L	N	C L	GT(N)	Succ(N)
(A,6)	A	A	F	(B,8) (D,8) (C,8)
(B,8) (D,8) (C,8)	B	A B	F	(D,9) (A,10)
(D,8) (C,8)	D	A B D	F	(E,13) (F,6) (A,11) (B,10)
(F,6) (C,8) (E,13)	F	A B D F	F	(G,8) (H,6) (C,16) (D,11)
(H,6) (C,8) (G,8) (E,13)	H	A B D F H	T	
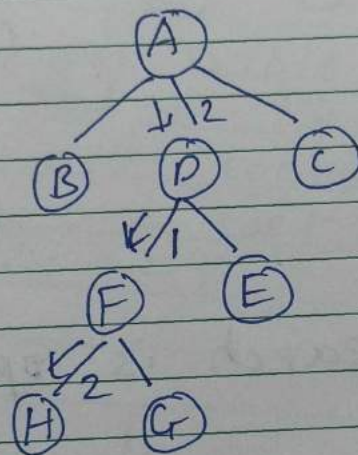
Path : A D F H
Cost = S

∴ A* is optimal and complete

h₁ is not admissible as it is overestimating the cost
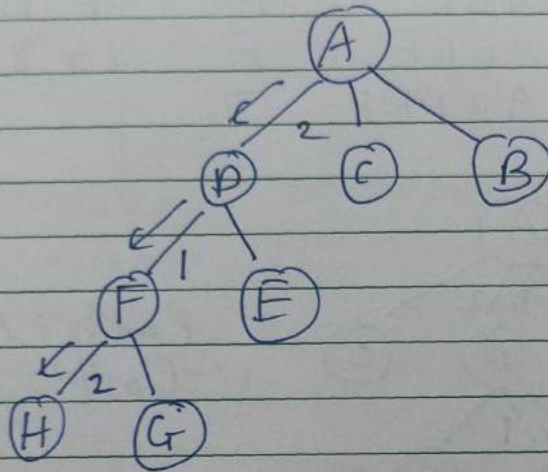h₁ is not consistent as heuristic arc cost > actual cost

Best first Search:- h_2

O L	N	C L	GT(N)	Succ(N)
(A,3)	A	A	F	(B,3) (D,2) (C,2)
(D,2)(C,2)(B,3)	D	AD	F	(E,2) (F,1)(A,3)(B,3)
(F,1) (E,2)(E,2)(B,3)	F	ADF	F	(G,1) (H,0)(C,2)(D,2)
(H,0)(G,1) (C,2)(E,2)(B3)	H	ADFH	T	

Path: A D F H
cost: 5

Best First search is optimal and complete:

A^*:

O L	N	C L	GT(N)	Succ(N)
(A,3)	A	A	F	(B,5) (D,4)(C,3)
(C,3)(D,4)(B,5)	C	AC	R	(F,7) (A,5)
(D,4)(B,5)(F,7)	D	ACD	F	(E,7) (F,4)(A,7)(B,6)
(F,4) (B,5)(E,7)	F	ACDF	F	(G,6) (H,5) (C,10) (D,6)
(B,5)(H,5)(G,6)(E,7)	B	ACDFB	F	(D,5) (A,7)
(H,5) (G,6) (E,7)	H	ACDFBH	T	
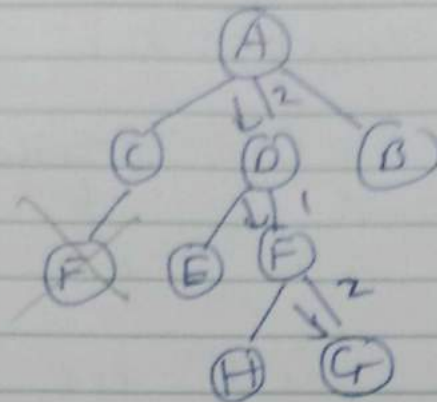
Path : ADFG
Cost : 5

∴ A* is optimal and complete.
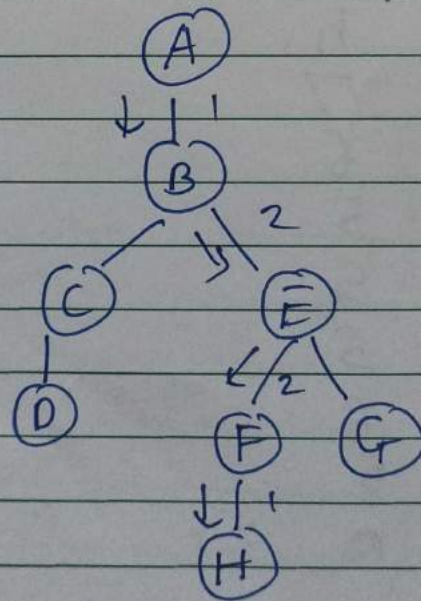
h_2 is admissible as it never over estimates the cost

h_2 is not consistent as heuristic arc cost for EF is 1, but actual is −1

Graph 2 :

	h_1	h_2
A	7	4
B	6	3
C	5	3
D	5	2
E	5	2
F	6	1
G	6	1
H	O	O

Best First Search: h1

OL	N	CL	GT(N)	succ(N)
(A,7)	A	A	F	(B,6)
(B,6)	B	A B	F	(C,5) (E,5)
(C,5) (E,5)	C	A B C	F	(D,5) (B,6)
(E,5) (D,5)	E	A B C E	F	(F,6) (G,5) (B,8)
(D,5) (F,6)(G,6)	D	A B C E D	F	(F,6) (C,5)
(F,6)(G,6)	F	A B C E D F	F	(D,5) (H,0) (E,5)
(H,0) (G,6)	H	A B C E D F H	T	

Path : A B E F H
Cost : 6

Best First search is not optimal but not complete

A*

OL	N	CL	GT(N)	Succ(N)
(A,7)	A	A	F	(B,7)
(B,7)	B	A B	F	(C,7) (E,8) (A,9)
(C,7) (E,8)	C	A BC	F	(D,13) (B,9)
(E,8) (D,13)	E	A BC E	F	(F,11) (G,10)(B,11)
(G,10) (F,11)(D,13	G	A BC E G	F	(H,5) (E,10)
(H,5) (F,11) (D,13)	H	ABCEGH	T	
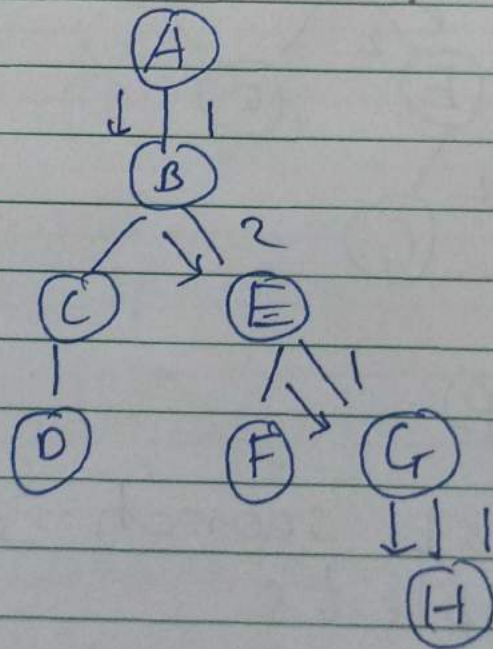
Path : ABEGH

Cost : 5

A* is optimal and complete

h_1 is not admissible as it over estimates the cost.

h_1 is not consistent as heuristic is arc cost > actual cost.

Best First Search : h_2

OL	N	CL	GT(N)	Succ(N)
(A,4)	A	A	F	(B,3)
(B,3)	B	AB	F	(C,3) (E,2) (A,4)
(E,2) (C,3)	E	ABE	F	(F,1) (G,1) (B,3)
(F,1) (G,1) (C,3)	F	ABEF	F	(D,2) (H,0) (E,2)
(H,0) (G,1) (D,2) (C,3)	H	ABEFH	T	
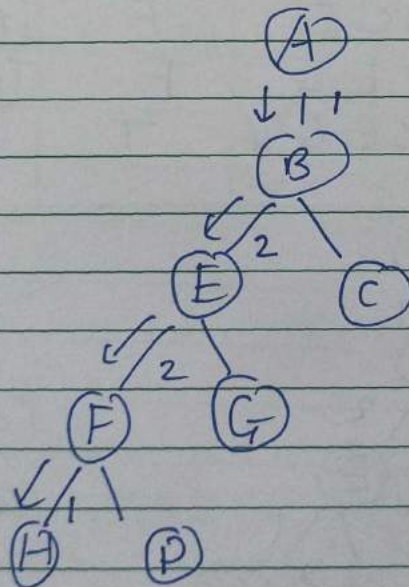
Path : ABEFH

Cost : 6

Best First search is not optimal but complete

A*

OL	N	CL	G+(C N)	Succ(N)
(A,4)	A	A	F	(B,4)
(B,4)	B	A B	F	(C,5) (E,5)(A,5)
(C,5) (E,5)	C	A B C	F	(D,10) (B,6)
(E,5) (D,10)	E	A B C E	F	(F,6)(G,5) (B,8)
(G,5)(F,6)(D,10)	G	A B C E G	F	(H,5) (E,7)
(H,5)(F,6)(E,7)(D,10)	H	A B C E G H	T	
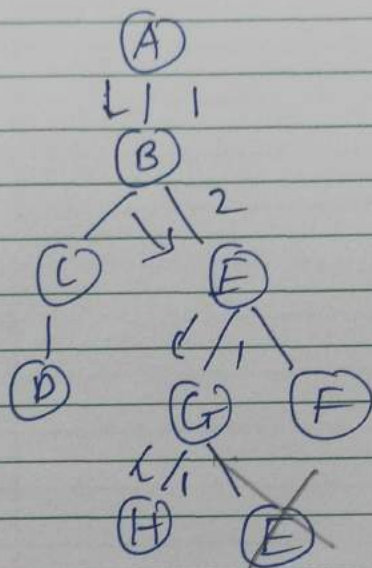
A

L | 1

B

2

C   E

D   G   F

H   E

Path : A B E G H

cost 5

∴ A* is optimal and complete

h₂ is admissible as it never
overestimates the cost
h₂ is consistent as heuristic
arc cost < actual cost