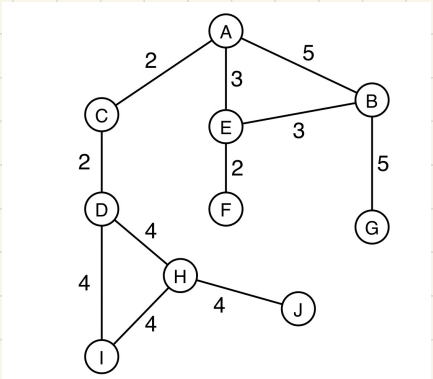


Node	A	B	C	D	E	F	G	H	I	J
h_1	10	6	8	5	5	3	1	3	4	0

(a) Greedy best-first graph search.

a)

Frontier	closed	Pruned	Expanded.
<A>,10			
~~<AE>5~~, <AB>6, <AC>8	A		<A>
~~<AEF>3~~, <AB>6, <AEB>6, <AC>8	A,E	<AEA>	<AE>
~~<AB>6~~, <AEB>6, <AC>8	A,E,F	<AEFE>	<AEF>
~~<ABG>1~~, <AEB>6, <AC>8	A,E,F,B	<ABA> <ABE>	<AB>
~~<AEB>6~~, <AC>8	A,E,F,B,G	<ABGB> <AEB>	<ABG>
~~<AC>8~~			
~~<ACD>5~~	A,E,F,B,G,C	<ACA>	<AC>

~~<ACDH>3~~,
<ACDI>4

A, E, F, B, G, G
D

<ACDC>

<ACD>

~~<ACDHJ>0~~
<ACDI>4
<ACDHI>4

A, E, F, B, G,
C, D, H

<ACDHD>

<ACDH>

A, E, F, B, G,
C, D, H, J

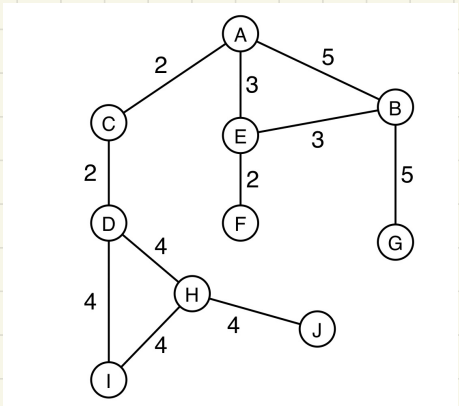
—

don't prune as last step.

<ACDHJ>

Path: ACDHJ cost: 12

9 expansions 9 Pruned.



Node	A	B	C	D	E	F	G	H	I	J
h_1	10	6	8	5	5	3	1	3	4	0

(b) A* graph search.

b)

Frontier	closed	Pruned	Expanded
<A>10	A		<A>
~~<AE>8~~, <AC>10 <AB>11	A, E	<AEA>	<AE>
~~<AEF>8~~, <AC>10 <AB>11, <AEB>12	A, E, F	<AEFE>	<AEF>
~~<AC>10~~, <AB>11, <AEB>12	A, E, F, C	<ACA>	<AC>
~~<ACD>9~~, <AB>11, <AEB>12	A, E, F, C, D	<ACDC>	<ACD>
~~<AB>11~~, <ACDH>11, <AEB>12, <ACDI>12	A, E, F, C, D, B	<ABA> <ABE>	<AB>
~~<ACDH>11~~, <ABE>11, <AEB>12, <ACDI>12	A, E, F, C, D, B, H	<ACDHD>	<ACDH>
<ABE>11, <AEB>12, <ACDI>12, <ACDHJ>12 <ACDHI>16			

~~<AEB>12,~~
<ACDI>12,
<ACDHJ>12,
<ACDHI>16

A, E, F, C, D, B, H, G.

<ABCGB> <ABG>

~~<ACDI>12,~~
<ACDHJ>12,
<ACDHI>16

<AEB>

~~<ACDHJ>12,~~
<ACDHI>16

A, E, F, C, D, B, H, G, I.

<ACDIDI> <ACDI>
<ACDIH>

A, E, F, C, D, B, H, G, I, J.

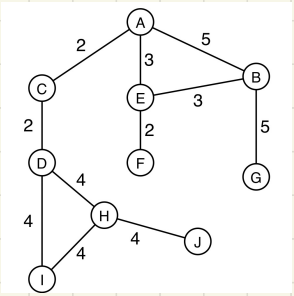
— <ACDHJ>

10 paths excluded.
11 paths pruned.
ACDHJ
cost: 12

2. Considering the state space from Question 1, suppose that you are given another heuristic, h_2, defined by the following table.

Node	A	B	C	D	E	F	G	H	I	J
h_2	10	6	10	10	5	3	1	3	4	0

Is this heuristic guaranteed to result in the optimal path being discovered by an A* graph search? Explain your reasoning.



2)

	h_2	actual	
A	10	12	✓
B	6	17	✓
C	10	10	✓
D	10	8	X
E	5	15	✓
F	3	17	✓
G	1	22	✓
H	3	4	✓
I	4	8	✓
J	0	0	✓

The actual optimal cost from D to J is 8 whereas the heuristics estimated value is 10

$10 \not\leq 8$

$\Rightarrow$ h_2 doesn't always provide an underestimate

$\Rightarrow$ h_2 isn't admissable

$\therefore$ NO; not always guaranteed optimal path using h_2.

3. Suppose that you have a set of heuristics $h_1, \ldots, h_n$. Which of the following overall heuristics is best and why, and which of them are admissible assuming that each h_i is admissible?

$H_1 = min\{h_1, \ldots, h_n\}$
$H_2 = max\{h_1, \ldots, h_n\}$
$H_3 = \sum_{i=1}^{n}\{h_1, \ldots, h_n\}$

Since all $h_1 \rightarrow h_n$ are admissable this suggests that using

H_1 or H_2 would result in still an admissable heuristic $\therefore$ h_1 & h_2 are admissable.

H_3 isn't admissable.

H_2 is the best heuristic as it will provide the highest heuristic value $\forall n$

$\Longrightarrow$

A^* expands all nodes with $f(n) < f^*$ (optimal)
all nodes where $h(n) < f^* - g(n)$

$\therefore$ a lower heuristic value means more nodes satisfy $h(n) < f^* - g(n)$

$\therefore$ higher heuristic values expand less node is 'better'.