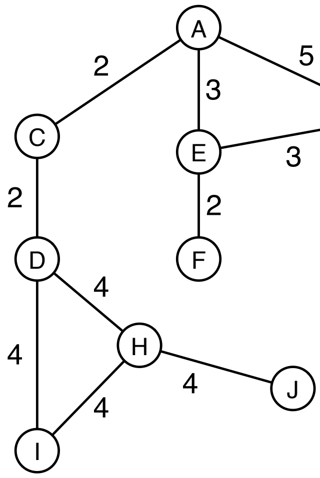
CS255: Artificial Intelligence
Seminar Sheet 2 — Informed Search

1. Consider the state space below where nodes represent valid states and edges represent valid transitions from one state to the next. The edges are labelled with their cost of traversal. The start state is labelled A and the goal state is labelled J.



Suppose that you are given a heuristic, h_1, defined by the following table.

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

For the each of the following graph search methods, (i) give the state of the frontier at each step of the search, (ii) give the state of the closed set at each step, (iii) list any paths that are pruned, and (iv) state the route found and its cost. You should apply cycle checking and multiple-path pruning. Note this means that when expanding a path $\langle n_0, \ldots, n_{k-1}, n_k \rangle$ there is no need to add the path $\langle n_0, \ldots, n_{k-1}, n_k, n_{k-1} \rangle$ back into the queue (as it will only be pruned later, and this is a simple optimisation).

(a) Greedy best-first graph search.

(b) A* graph search.

When selecting paths from the frontier, if two paths are equally desirable then the selection should be done aphabetically according to the nodes at the end of the paths. If there is a tie-break, then you should select the path that has been in the frontier the longest.

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.

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

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