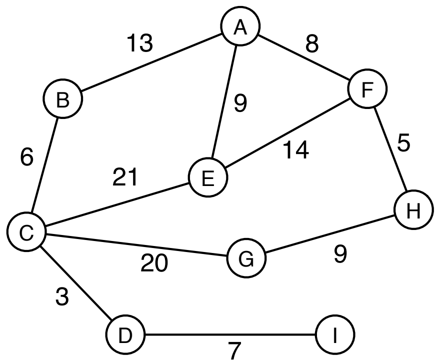
4. (a) Consider the state space shown below, in which the arcs represent the legal successors of a node. Arcs are bi-directional and are labelled with the cost of performing the corresponding action. The start state is **A** and the goal is **I**. Suppose that you are given a heuristic, h_1, defined by the following table.

Node	A	B	C	D	E	F	G	H	I
h_1	20	15	10	7	21	20	27	26	0



For each of the following search methods, show the resulting search tree, list the sequence in which nodes are removed from the queue, and state how many nodes are expanded. You should also state the route found and its associated cost. Assume that nodes are inserted into the queue in alphabetical order. When expanding a node, do not generate any of its ancestors.

i. Uniform cost search [6]

ii. Greedy best-first search [4]

iii. A* search [5]

(b) Consider the problem of starting in state **I** with **A** being the goal state, in the same state space as above. Suppose that you are given a heuristic, h_2, defined by the following table.

Node	A	B	C	D	E	F	G	H	I
h_2	0	25	19	20	5	8	15	13	20

i. Use A* to determine a route from **I** to **A** using h_2 as the heuristic, showing your search tree and giving the sequence of nodes expanded. State the route found and its associated cost. [4]

ii. Given that you might expect the same route between A-I and I-A, which is the better heuristic, h_1 or h_2, and why? [2]

(c) Formally prove that A* is an optimal search strategy for locally finite graphs. [4]