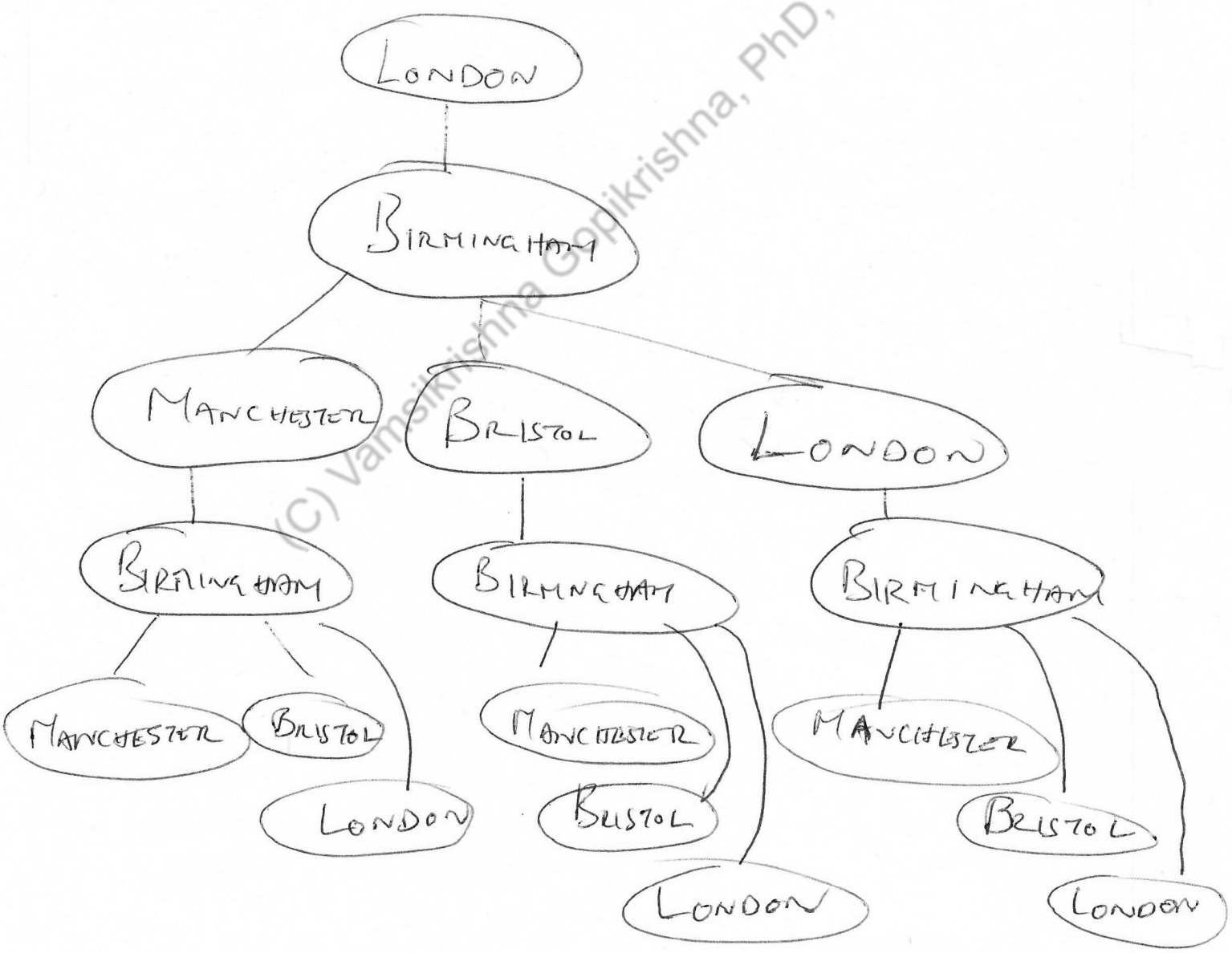
Assignment 1 - Solution

Task 1

See Code

Task 2



BFS

DRESDEN, LEPZIG, BERLIN, DRESDEN, NUREMBERG

MAGDEBURG, DRESDEN, MAGDEBURG,

HAMBURG

DFS

DRESDEN, LEPZIG, MAGDEBURG, HANNOVER,

BREMEN, HAMBURG.

UCS

DRESDEN (0), LEIPZIG (14), BERLIN (204),

DRESDEN (238), MAGDEBORG (244),

LEPZIG (357), LEPZIG (369),

MAGDEBURG (370), NUREBBERG (382), HANNOVER (392)

IDS

DL:0 DRESDEN

DL:1 DRESDEN, LEPZIG, BERLIN.

DL:2 DRESDEN, LEDZIG, MAGDEBORA, DRESDEN, NUREMBURG

BERLIN, DRESDEN, MAGDEBURG, HAMSURG.

TASK 3.

(i) DFS can run for infinite time but even if it finds solution it is not guaranteed to be optimal.

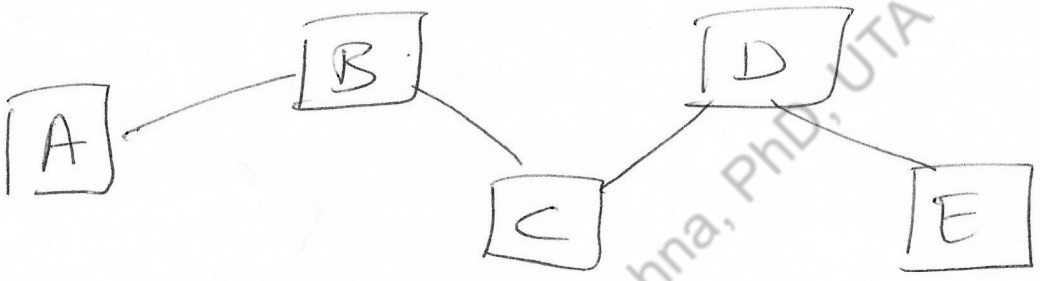
Since shallowest solution is also the optimal solution, UCS, BFS & IDS will find optimal solution.

(ii) Changing to graph search will not change this. The only difference is that DFS is now complete

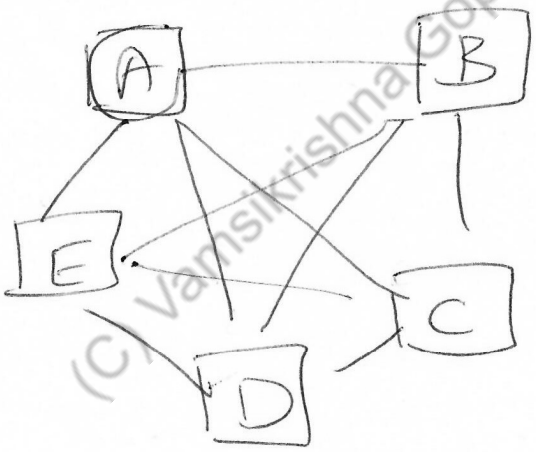
(iii)

No. A state (vertex in SNA) can correspond to multiple nodes in the Search tree.

(iv)



(v)



(vi)

Keep a closed set of states already visited. If a successor node is generated that represents a state already in closed, do not add to fringe and discard from memory.

TASK 4

CONSIDER $h^*(n)$

$h^*(A) = 17$

$h^*(B) = 14$

$h^*(C) = 10$

$h^*(D) = 12$

$h^*(E) = 7$

$h^*(F) = 4$

$h^*(G) = 0$

The following changes must be made to make the heuristics admissible

Heuristic 1

$h(A) \leq 17$ $\quad h(G) = 0$

$h(F) \leq 4$ $\quad h(B) \leq 14$

Heuristic 2

$h(A) \leq 17$

$h(B) \leq 14$

$h(C) \leq 10$

$h(D) \leq 12$

$h(E) \leq 7$

$h(F) \leq 4$

$h(G) = 0$

Heuristic 3

$h(G) = 0$

Heuristic 4

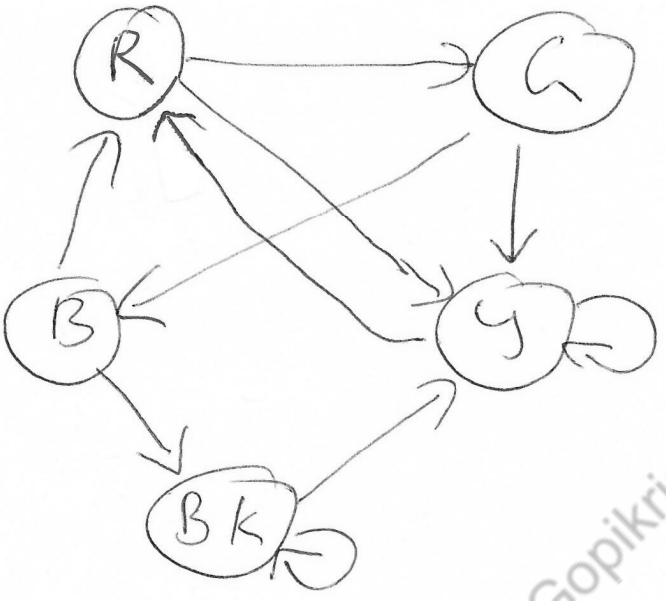
Already admissible

Heuristic 5

Already admissible.

TASK 5

Consider the toy problem



The cost of optimal path here gives the values for the heuristic.

$h(R) = 3$

$h(B) = 1$

$h(G) = 2$

$h(Y) = 4$

$h(BK) = 0$

Task 6

For this problem,

$b = 4$ $\quad C^* = d$

$d = [100 \quad 208]$ $\quad \varepsilon = 1$

$m = \infty$

Memory complexity

DFS : $bm = \infty$ KB

BFS : $b^{d+1} = [4^{101} \quad 4^{209}]$ KB

IDS : $bd = [400 \quad 832]$ KB

UCS : $b^{C^*/\varepsilon} = [4^{100} \quad 4^{208}]$ KB

(a) None of the above is < 100 KB

(b) IDS will at maximum need 832 KB so will never need > 1000 KB