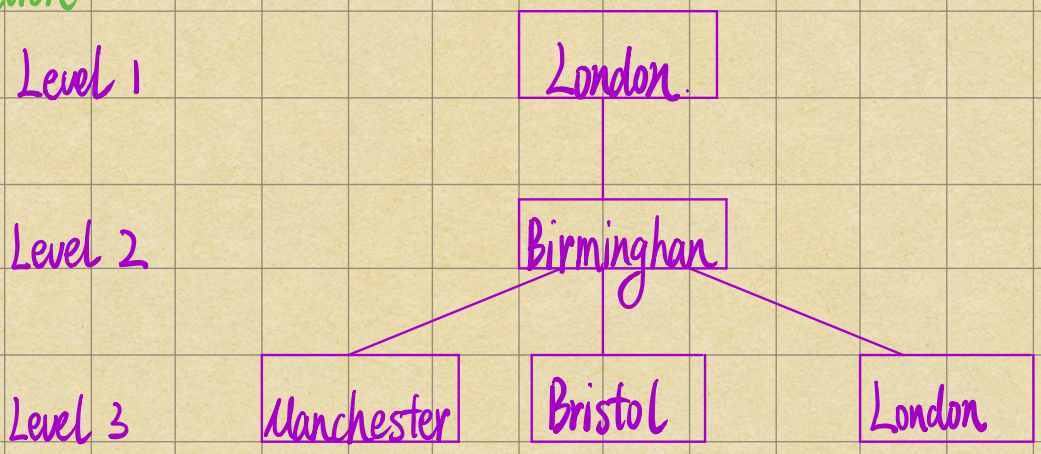
Task 2:

1° Draw the first three levels of the search tree starting from London.

Solution:



2° Solution:

1' Breadth-First Search:

(Dresden), (Leipzig, Berlin), (Magdeburg, Nuremburg)

level 1 level 2 level 3

2' Depth-First Search:

Dresden, Berlin, Hamburg, Luebeck, Bremen.

level 1 level 2 level 3 level 4 level 4

3' Iterative Deepening Search:

Limit = 0 : Dresen

Limit = 1 : Dresen, Leipzig, Berlin

Limit = 2 : Dresen, Leipzig, Nuremburg, Magdeburg, Berlin.

Limit = 3 : Dresen, Leipzig, Nuremburg, Munich, Struttgart.

Limit = 4 : Dresen, Leipzig, Nuremburg, Munich, Struttgart.

4' Uniform-cost Search: city (cost)

Dresen (0), Leipzip (119), Berlin (204), Magdeburg (119+125=244)

Nuremburg (119+263=382)

Task 3:

1° Solution:

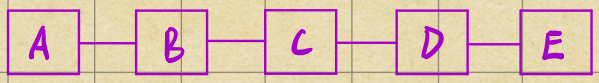
BFS (Breadth-First Search) and UCS (Uniform-cost Search) and IDS (Iterative deepen search). can guarantee finding the correct number required. Because those three methods are complete according to the textbook. In addition: UCS (Uniform cost search) is applicable as long as we consider the "cost" among the nodes are iterative steps.

2° Solution:

Because the search algorithm does not try to avoid revisiting the same state, and the SNG graph is a undirect graph, thus it is impossible to achieve the one-to-one correspondence.

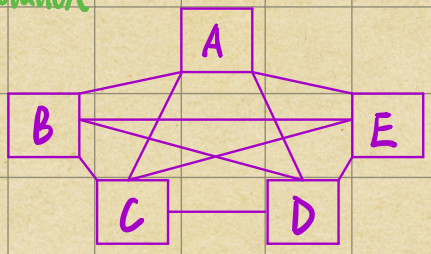
There should be one-to-multiple correspondence.

3° Solution:



The degree of A and E is 4

4° Solution:



5° Solution:

Consider the space complexity of Breadth-first search:

keep every node in memory $O(b^{d+1})$. Let's say the worst case which everyone knows each other that leads to $b=10^6-1$, and everyone don't know each other that leads to $d=0$

According to the problem: $b=10^6-1$, $d=0+1=1$, so the nodes in memory would not more than 1GB.

In addition, We can just pop out the visited nodes that can form a loop to save memory. Because the degrees in the sub-connected graph are fixed, so we can delete them safely.

Task 4:

Overall, the h^* of each node is

$h^*(A)=17$, $h^*(B)=14$, $h^*(C)=10$, $h^*(D)=12$,

$h^*(E)=7$, $h^*(F)=4$, $h^*(G)=0$, we need to make sure $h(n) \leq h^*(n)$, as a result

1° Heuristic 1:

Inadmissable, modify $h(A), h(B), h(F), h(G)$

$h(A)=17$, $h(B)=14$, $h(F)=7$, $h(G)=0$

2° Heuristic 2:

Inadmissable, modify $h(A), h(B), h(C), h(D), h(E), h(F), h(G)$

$h(A)=17$, $h(B)=14$, $h(C)=10$, $h(D)=12$, $h(E)=7$, $h(F)=4$, $h(G)=0$

3° Heuristic 3:

Inadmissable, modify $h(G)$

$h(G)=0$

4° Heuristic 4:

Admissable

5° Heuristic 5:

Admissable

Task 5: Solution

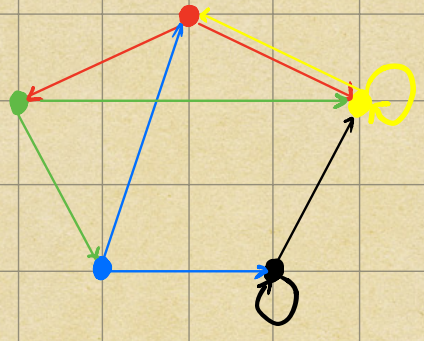
$h(red)=3$

$h(green)=2$

$h(blue)=1$

$h(yellow)=4$

$h(black)=0$



Task 6 : Solution

Consider the space complexity of each algorithm:

Breadth-first search: keep every node in memory $O(b^{d+1})$

Uniform-cost search: keep nodes with $g \leq$ cost of optimal solution. $O(b^{\lceil C^*/\varepsilon \rceil})$

Depth-first Search: linear space $O(bm)$

Iterative deepening search: linear space $O(bd)$

b: maxium branching factor

d: depth of least-cost

m: maxium length of any path in the state space

And for some initial states, the shortest solution is longer than 100 moves

for all initial states, the shortest solution is at most 208. moves.

And in each state we can have at most 4 move.

Thus $b=4$, $m=208$, $d=100$. We obtain $b^{d+1}=4^{101}$, $b \cdot m = 832$, $b \cdot d = 400$.

(a) No method can guarantee that never use more than 100 KB.

(b) DFS & IDS which at most have 832 KB and 400 KB are acceptable.