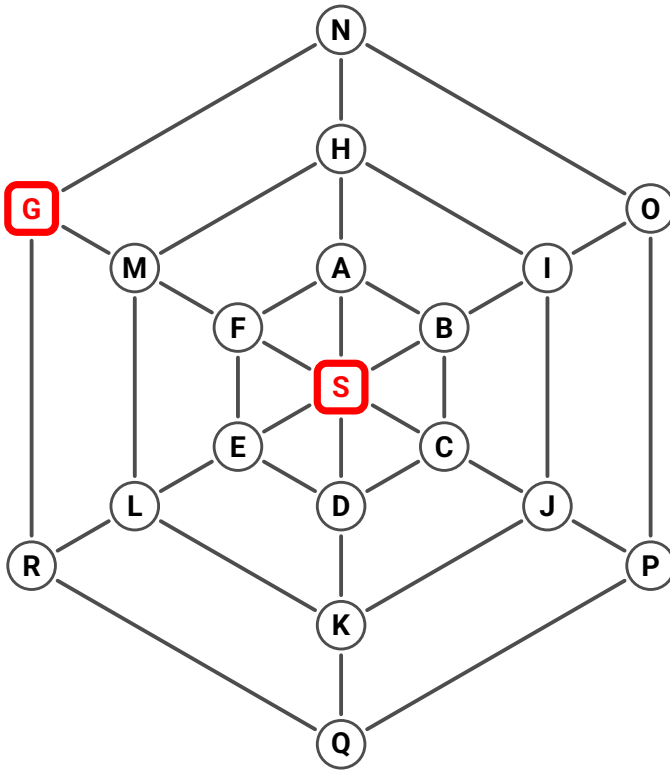


Problem 7

Depth First Iterative Deepening (DFID-N)

Prepared by S. Baskaran

State Space



MoveGen returns nodes in ALPHABETICAL order.

S → A, B, C, D, E, F

A \rightarrow B, F, H, S

B \rightarrow A, C, I, S

C -> B, D, J, S

D -> C, E, K, S

E -> D, F, L, S

F -> A, E, M, S

H -> A, I, M, N

$$I \rightarrow B, H, J, 0$$

J -> C, I, K, P

K \rightarrow D, J, L, Q

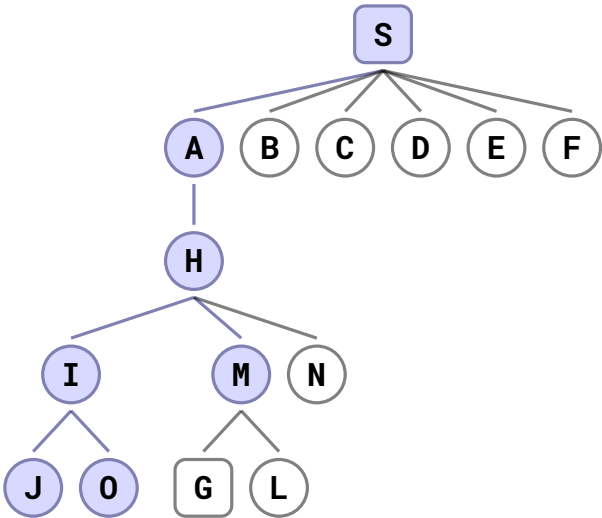
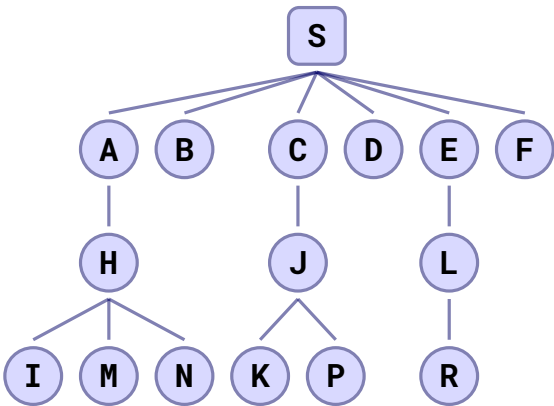
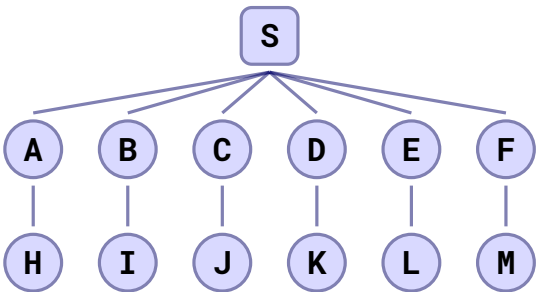
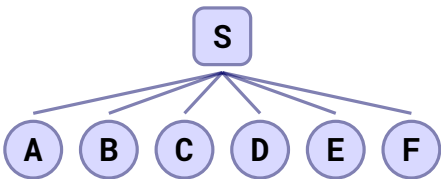
L \rightarrow E, K, M, R

M \rightarrow F, G, H, L

$$N \rightarrow G, H, O$$
$$0 \rightarrow I, N, P$$
$$P \rightarrow J, 0, Q$$
$$Q \rightarrow K, P, R$$
$$R \rightarrow G, L, Q$$
$$G \rightarrow M, N, R$$

DFID-N Search Trees (d=0,1,2,3,4)

S



DFID-N Solution

The solution provided below is based on the DFID-N algorithm published in the Week 2 Notes.

```
OPEN and CLOSED carry triples: (NODE,PARENT,DEPTH)

***[DEPTH BOUND = 0]***

OPEN      (S,null,0):[]
CLOSED    []

1.
NODE      S
close     (S,null,0)

OPEN      []
CLOSED    (S,null,0):[]

***[DEPTH BOUND = 1]***

OPEN      (S,null,0):[]
CLOSED    []

1.
NODE      S
close     (S,null,0)
moveGen   A:B:C:D:E:F:[]
newNodes  A:B:C:D:E:F:[]
newPairs  (A,S,1):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]

OPEN      (A,S,1):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]
CLOSED    (S,null,0):[]

2.
NODE      A
close     (A,S,1)

OPEN      (B,S,1):(C,S,1):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (A,S,1):(S,null,0):[]

3.
NODE      B
close     (B,S,1)

OPEN      (C,S,1):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (B,S,1):(A,S,1):(S,null,0):[]

4.
NODE      C
close     (C,S,1)

OPEN      (D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (C,S,1):(B,S,1):(A,S,1):(S,null,0):[]

5.
NODE      D
close     (D,S,1)

OPEN      (E,S,1):(F,S,1):[]
CLOSED    (D,S,1):(C,S,1):(B,S,1):(A,S,1):(S,null,0):[]

6.
NODE      E
close     (E,S,1)

OPEN      (F,S,1):[]
CLOSED    (E,S,1):(D,S,1):(C,S,1):(B,S,1):(A,S,1):
          (S,null,0):[]

7.
NODE      F
close     (F,S,1)

OPEN      []
CLOSED    (F,S,1):(E,S,1):(D,S,1):(C,S,1):(B,S,1):
          (A,S,1):(S,null,0):[]

***[DEPTH BOUND = 2]***

OPEN      (S,null,0):[]
CLOSED    []

1.
NODE      S
close     (S,null,0)
moveGen   A:B:C:D:E:F:[]
newNodes  A:B:C:D:E:F:[]
newPairs  (A,S,1):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]

OPEN      (A,S,1):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]
CLOSED    (S,null,0):[]

2.
NODE      A
close     (A,S,1)
moveGen   B:F:H:S:[]
newNodes  H:[]
newPairs  (H,A,2):[]

OPEN      (H,A,2):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]
CLOSED    (A,S,1):(S,null,0):[]

3.
NODE      H
close     (H,A,2)

OPEN      (B,S,1):(C,S,1):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (H,A,2):(A,S,1):(S,null,0):[]

4.
NODE      B
close     (B,S,1)
moveGen   A:C:I:S:[]
newNodes  I:[]
newPairs  (I,B,2):[]

OPEN      (I,B,2):(C,S,1):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (B,S,1):(H,A,2):(A,S,1):(S,null,0):[]

5.
NODE      I
close     (I,B,2)

OPEN      (C,S,1):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (I,B,2):(B,S,1):(H,A,2):(A,S,1):(S,null,0):[]

6.
NODE      C
close     (C,S,1)
moveGen   B:D:J:S:[]
newNodes  J:[]
newPairs  (J,C,2):[]

OPEN      (J,C,2):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (C,S,1):(I,B,2):(B,S,1):(H,A,2):(A,S,1):
          (S,null,0):[]

7.
NODE      J
close     (J,C,2)

OPEN      (D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (J,C,2):(C,S,1):(I,B,2):(B,S,1):(H,A,2):
          (A,S,1):(S,null,0):[]

8.
NODE      D
close     (D,S,1)
moveGen   C:E:K:S:[]
newNodes  K:[]
newPairs  (K,D,2):[]

OPEN      (K,D,2):(E,S,1):(F,S,1):[]
CLOSED    (D,S,1):(J,C,2):(C,S,1):(I,B,2):(B,S,1):
          (H,A,2):(A,S,1):(S,null,0):[]

9.
NODE      K
close     (K,D,2)

OPEN      (E,S,1):(F,S,1):[]
CLOSED    (K,D,2):(D,S,1):(J,C,2):(C,S,1):(I,B,2):
          (B,S,1):(H,A,2):(A,S,1):(S,null,0):[]

10.
NODE      E
close     (E,S,1)
moveGen   D:F:L:S:[]
newNodes  L:[]
newPairs  (L,E,2):[]

OPEN      (L,E,2):(F,S,1):[]
CLOSED    (E,S,1):(K,D,2):(D,S,1):(J,C,2):(C,S,1):
          (I,B,2):(B,S,1):(H,A,2):(A,S,1):(S,null,0):[]

11.
NODE      L
close     (L,E,2)

OPEN      (F,S,1):[]
CLOSED    (L,E,2):(E,S,1):(K,D,2):(D,S,1):(J,C,2):
          (C,S,1):(I,B,2):(B,S,1):(H,A,2):(A,S,1):
          (S,null,0):[]

12.
NODE      F
close     (F,S,1)
moveGen   A:E:M:S:[]
newNodes  M:[]
newPairs  (M,F,2):[]

OPEN      (M,F,2):[]
CLOSED    (F,S,1):(L,E,2):(E,S,1):(K,D,2):(D,S,1):
          (J,C,2):(C,S,1):(I,B,2):(B,S,1):(H,A,2):
          (A,S,1):(S,null,0):[]

13.
NODE      M
close     (M,F,2)

OPEN      []
CLOSED    (M,F,2):(F,S,1):(L,E,2):(E,S,1):(K,D,2):
          (D,S,1):(J,C,2):(C,S,1):(I,B,2):(B,S,1):
          (H,A,2):(A,S,1):(S,null,0):[]

***[DEPTH BOUND = 3]***

OPEN      (S,null,0):[]
CLOSED    []

1.
NODE      S
close     (S,null,0)
moveGen   A:B:C:D:E:F:[]
newNodes  A:B:C:D:E:F:[]
newPairs  (A,S,1):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]

OPEN      (A,S,1):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]
CLOSED    (S,null,0):[]

2.
NODE      A
close     (A,S,1)
moveGen   B:F:H:S:[]
newNodes  H:[]
newPairs  (H,A,2):[]

OPEN      (H,A,2):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]
CLOSED    (A,S,1):(S,null,0):[]

3.
NODE      H
close     (H,A,2)
moveGen   A:I:M:N:[]
newNodes  I:M:N:[]
newPairs  (I,H,3):(M,H,3):(N,H,3):[]

OPEN      (I,H,3):(M,H,3):(N,H,3):(B,S,1):(C,S,1):
          (D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (H,A,2):(A,S,1):(S,null,0):[]

4.
NODE      I
close     (I,H,3)

OPEN      (M,H,3):(N,H,3):(B,S,1):(C,S,1):(D,S,1):
          (E,S,1):(F,S,1):[]
CLOSED    (I,H,3):(H,A,2):(A,S,1):(S,null,0):[]

5.
NODE      M
close     (M,H,3)

OPEN      (N,H,3):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]
CLOSED    (M,H,3):(I,H,3):(H,A,2):(A,S,1):(S,null,0):[]

6.
NODE      N
close     (N,H,3)

OPEN      (B,S,1):(C,S,1):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (N,H,3):(M,H,3):(I,H,3):(H,A,2):(A,S,1):
          (S,null,0):[]

7.
NODE      B
close     (B,S,1)
moveGen   A:C:I:S:[]
newNodes  []
newPairs  []

OPEN      (C,S,1):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (B,S,1):(N,H,3):(M,H,3):(I,H,3):(H,A,2):
          (A,S,1):(S,null,0):[]

8.
NODE      C
close     (C,S,1)
moveGen   B:D:J:S:[]
newNodes  J:[]
newPairs  (J,C,2):[]

OPEN      (J,C,2):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (C,S,1):(B,S,1):(N,H,3):(M,H,3):(I,H,3):
          (H,A,2):(A,S,1):(S,null,0):[]

9.
NODE      J
close     (J,C,2)
moveGen   C:I:K:P:[]
newNodes  K:P:[]
newPairs  (K,J,3):(P,J,3):[]

OPEN      (K,J,3):(P,J,3):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (J,C,2):(C,S,1):(B,S,1):(N,H,3):(M,H,3):
          (I,H,3):(H,A,2):(A,S,1):(S,null,0):[]

10.
NODE      K
close     (K,J,3)

OPEN      (P,J,3):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (K,J,3):(J,C,2):(C,S,1):(B,S,1):(N,H,3):
          (M,H,3):(I,H,3):(H,A,2):(A,S,1):(S,null,0):[]

11.
NODE      P
close     (P,J,3)

OPEN      (D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (P,J,3):(K,J,3):(J,C,2):(C,S,1):(B,S,1):
          (N,H,3):(M,H,3):(I,H,3):(H,A,2):(A,S,1):
          (S,null,0):[]

12.
NODE      D
close     (D,S,1)
moveGen   C:E:K:S:[]
newNodes  []
newPairs  []

OPEN      (E,S,1):(F,S,1):[]
CLOSED    (D,S,1):(P,J,3):(K,J,3):(J,C,2):(C,S,1):
          (B,S,1):(N,H,3):(M,H,3):(I,H,3):(H,A,2):
          (A,S,1):(S,null,0):[]

13.
NODE      E
close     (E,S,1)
moveGen   D:F:L:S:[]
newNodes  L:[]
newPairs  (L,E,2):[]

OPEN      (L,E,2):(F,S,1):[]
CLOSED    (E,S,1):(D,S,1):(P,J,3):(K,J,3):(J,C,2):
          (C,S,1):(B,S,1):(N,H,3):(M,H,3):(I,H,3):
          (H,A,2):(A,S,1):(S,null,0):[]

14.
NODE      L
close     (L,E,2)
moveGen   E:K:M:R:[]
newNodes  R:[]
newPairs  (R,L,3):[]

OPEN      (R,L,3):(F,S,1):[]
CLOSED    (L,E,2):(E,S,1):(D,S,1):(P,J,3):(K,J,3):
          (J,C,2):(C,S,1):(B,S,1):(N,H,3):(M,H,3):
          (I,H,3):(H,A,2):(A,S,1):(S,null,0):[]

15.
NODE      R
close     (R,L,3)

OPEN      (F,S,1):[]
CLOSED    (R,L,3):(L,E,2):(E,S,1):(D,S,1):(P,J,3):
          (K,J,3):(J,C,2):(C,S,1):(B,S,1):(N,H,3):
          (M,H,3):(I,H,3):(H,A,2):(A,S,1):(S,null,0):[]

16.
NODE      F
close     (F,S,1)
moveGen   A:E:M:S:[]
newNodes  []
newPairs  []

OPEN      []
CLOSED    (F,S,1):(R,L,3):(L,E,2):(E,S,1):(D,S,1):
          (P,J,3):(K,J,3):(J,C,2):(C,S,1):(B,S,1):
          (N,H,3):(M,H,3):(I,H,3):(H,A,2):(A,S,1):
          (S,null,0):[]

***[DEPTH BOUND = 4]***

OPEN      (S,null,0):[]
CLOSED    []

1.
NODE      S
close     (S,null,0)
moveGen   A:B:C:D:E:F:[]
newNodes  A:B:C:D:E:F:[]
newPairs  (A,S,1):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]

OPEN      (A,S,1):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]
CLOSED    (S,null,0):[]

2.
NODE      A
close     (A,S,1)
moveGen   B:F:H:S:[]
newNodes  H:[]
newPairs  (H,A,2):[]

OPEN      (H,A,2):(B,S,1):(C,S,1):(D,S,1):(E,S,1):
          (F,S,1):[]
CLOSED    (A,S,1):(S,null,0):[]

3.
NODE      H
close     (H,A,2)
moveGen   A:I:M:N:[]
newNodes  I:M:N:[]
newPairs  (I,H,3):(M,H,3):(N,H,3):[]

OPEN      (I,H,3):(M,H,3):(N,H,3):(B,S,1):(C,S,1):
          (D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (H,A,2):(A,S,1):(S,null,0):[]

4.
NODE      I
close     (I,H,3)
moveGen   B:H:J:O:[]
newNodes  J:O:[]
newPairs  (J,I,4):(O,I,4):[]

OPEN      (J,I,4):(O,I,4):(M,H,3):(N,H,3):(B,S,1):
          (C,S,1):(D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (I,H,3):(H,A,2):(A,S,1):(S,null,0):[]

5.
NODE      J
close     (J,I,4)

OPEN      (O,I,4):(M,H,3):(N,H,3):(B,S,1):(C,S,1):
          (D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (J,I,4):(I,H,3):(H,A,2):(A,S,1):(S,null,0):[]

6.
NODE      O
close     (O,I,4)

OPEN      (M,H,3):(N,H,3):(B,S,1):(C,S,1):(D,S,1):
          (E,S,1):(F,S,1):[]
CLOSED    (O,I,4):(J,I,4):(I,H,3):(H,A,2):(A,S,1):
          (S,null,0):[]

7.
NODE      M
close     (M,H,3)
moveGen   F:G:H:L:[]
newNodes  G:L:[]
newPairs  (G,M,4):(L,M,4):[]

OPEN      (G,M,4):(L,M,4):(N,H,3):(B,S,1):(C,S,1):
          (D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (M,H,3):(O,I,4):(J,I,4):(I,H,3):(H,A,2):
          (A,S,1):(S,null,0):[]

8.
NODE      G
GOAL      G

OPEN      (G,M,4):(L,M,4):(N,H,3):(B,S,1):(C,S,1):
          (D,S,1):(E,S,1):(F,S,1):[]
CLOSED    (M,H,3):(O,I,4):(J,I,4):(I,H,3):(H,A,2):
          (A,S,1):(S,null,0):[]

PATH      S:A:H:M:G:[]
```