

## Assignment 6

### Question 1

**Set of nodes** = { 1, 2, 3, 4, 5, 6, 7}

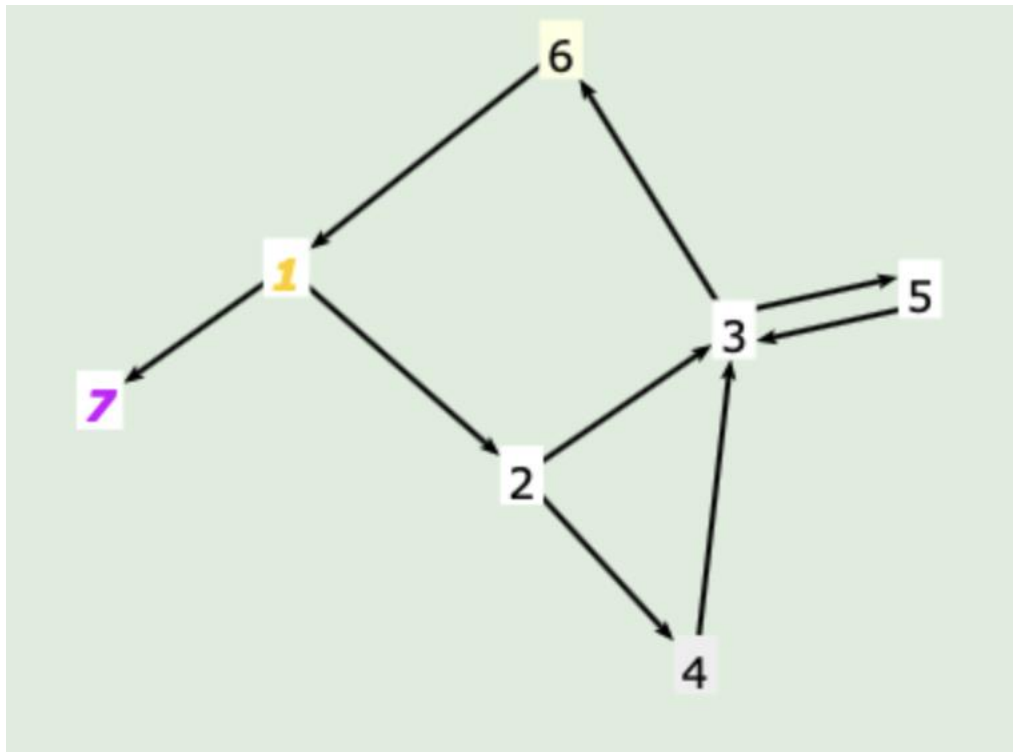
**Set of initial nodes** = {1}

**Set of final nodes** = {7}

**Set of edges** = {(1, 2), (2, 3), (2, 4), (4, 3), (3, 5), (3, 6), (5, 3), (6, 1), (1, 7)}

a) (5 points) Draw the graph.

Answer:



b) List the test requirements for edge-pair coverage.

Answer:

14 requirements are needed for Edge-Pairs

## Assignment 6

1. [1,2,3]
2. [1,2,4]
3. [2,3,5]
4. [2,3,6]
5. [2,4,3]
6. [4,3,5]
7. [4,3,6]
8. [3,5,3]
9. [3,6,1]
10. [5,3,5]
11. [5,3,6]
12. [6,1,2]
13. [6,1,7]
14. [1,7]

Consider the following three test paths:

1. [1, 2, 4, 3, 6, 1, 7]
2. [1, 2, 3, 5, 3, 6, 1, 7]
3. [1, 2, 4, 3, 5, 3, 6, 1, 2, 3, 6, 1, 7]

c) (2 points) Do the test paths 1 and 2 (taken together) satisfy edge-pair coverage? If not, identify what is missing.

Answer:

No, the test paths 1 and 2 (taken together) do not satisfy the edge-pair coverage.

Missing edge pairs: [2,3,6], [4,3,5],[5,3,5],[6,1,2]

d) (3 points) Consider the simple path [1, 2, 4, 3, 6]. Does test path 3 tour the simple path directly? With a sidetrip? If so, identify the sidetrip. With a detour? If so, identify the detour.

Answer:

Test path 3 does not tour the simple path [1,2,4,3,6] directly but using a sidetrip. Side trip is  $3 \Rightarrow 5 \Rightarrow 3$

Test path 3 does not tour the simple path [1,2,4,3,6] using a detour.

## Assignment 6

e) List the test requirements for node coverage, edge coverage, and prime path coverage on the graph.

TR for node coverage:

- [1]
- [2]
- [3]
- [4]
- [5]
- [6]
- [7]

TR for edge coverage:

9 requirements are needed for Edges

- [1,2]
- [2,3]
- [2,4]
- [4,3]
- [3,5]
- [3,6]
- [5,3]
- [6,1]
- [1,7]

17 requirements are needed for Prime Paths

1. [2,4,3,6,1,7]
2. [4,3,6,1,2,4]
3. [2,4,3,6,1,2]
4. [1,2,4,3,6,1]
5. [3,6,1,2,4,3]
6. [6,1,2,4,3,6]
7. [6,1,2,4,3,5]
8. [5,3,6,1,2,4]
9. [2,3,6,1,7]
10. [2,3,6,1,2]
11. [1,2,3,6,1]
12. [6,1,2,3,5]
13. [6,1,2,3,6]
14. [5,3,6,1,7]
15. [3,6,1,2,3]
16. [5,3,5]

## Assignment 6

17. [3,5,3]

f) (2 points) List test paths that achieve node coverage but not edge coverage on the graph:

Answer:

[1,2,4,3,5,3,6,1,7] this path covers all the nodes but does not cover all the edges like (2,3)

g) (3 points) List test paths that achieve edge coverage but not prime path coverage on the graph.

The test path [1,2,4,3,6,1,2,3,5,3,6,1,7] does achieve the edge coverage but not the prime path coverage.

The missing prime paths here:

1. [2,4,3,6,1,7]
2. [4,3,6,1,2,4]
3. [3,6,1,2,4,3]
4. [6,1,2,4,3,6]
5. [6,1,2,4,3,5]
6. [5,3,6,1,2,4]
7. [2,3,6,1,7]
8. [2,3,6,1,2]
9. [1,2,3,6,1]
10. [6,1,2,3,6]
11. [5,3,5]

## Assignment 6

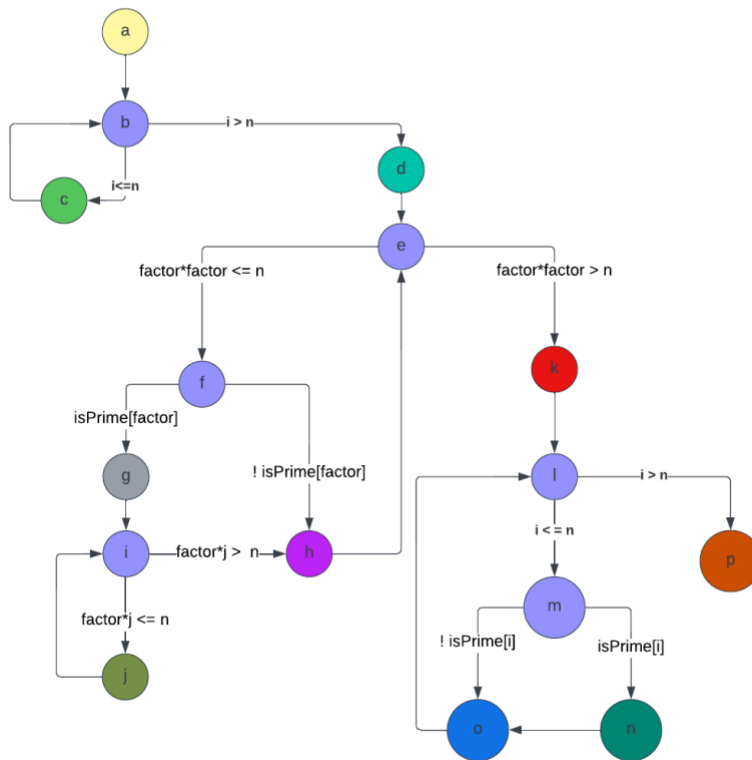
Question 2:

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1. int n = Integer.parseInt(args[0]);
2. boolean[] isPrime = new boolean[n+1];
3. for (int i = 2; i <= n; i++) {
4.     isPrime[i] = true;
5. }
6. for (int factor = 2; factor*factor <= n; factor++) {
7.     if (isPrime[factor]) {
8.         for (int j = factor; factor*j <= n; j++) {
9.             isPrime[factor*j] = false;
10.        }
11.    }
12. }
13. int primes = 0;
14. for (int i = 2; i <= n; i++) {
15.     if (isPrime[i]) primes++;
16. }
17. System.out.println("The number of primes <= " + n + " is " + primes);

```

a) Corresponding executing statements are colored in the nodes. All the branching nodes are colored same.



## Assignment 6

b) 16 requirements are needed for Nodes

[a]  
[b]  
[c]  
[d]  
[e]  
[f]  
[g]  
[i]  
[j]  
[h]  
[k]  
[l]  
[m]  
[n]  
[o]  
[p]

21 requirements are needed for Edges

[a,b]  
[b,c]  
[c,b]  
[b,d]  
[d,e]  
[e,f]  
[f,g]  
[g,i]  
[i,j]  
[j,i]  
[i,h]  
[f,h]  
[h,e]  
[e,k]  
[k,l]  
[l,m]  
[m,n]  
[n,o]  
[m,o]  
[o,l]  
[l,p]

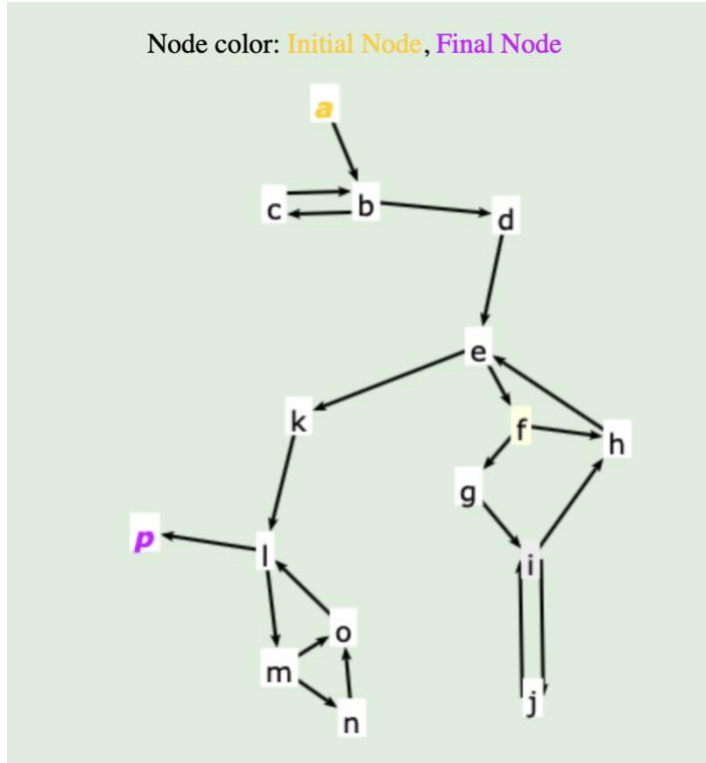
45 requirements are needed for Prime Paths

1. [f,g,i,h,e,k,l,m,n,o]
2. [c,b,d,e,k,l,m,n,o]

## Assignment 6

3. [a,b,d,e,k,l,m,n,o]
4. [f,g,i,h,e,k,l,m,o]
5. [j,i,h,e,k,l,m,n,o]
6. [c,b,d,e,f,g,i,h]
7. [c,b,d,e,f,g,i,j]
8. [c,b,d,e,k,l,m,o]
9. [a,b,d,e,k,l,m,o]
10. [a,b,d,e,f,g,i,j]
11. [a,b,d,e,f,g,i,h]
12. [j,i,h,e,k,l,m,o]
13. [f,h,e,k,l,m,n,o]
14. [f,g,i,h,e,k,l,p]
15. [c,b,d,e,k,l,p]
16. [a,b,d,e,k,l,p]
17. [f,h,e,k,l,m,o]
18. [j,i,h,e,k,l,p]
19. [f,g,i,h,e,f]
20. [e,f,g,i,h,e]
21. [a,b,d,e,f,h]
22. [c,b,d,e,f,h]
23. [h,e,f,g,i,j]
24. [f,h,e,k,l,p]
25. [h,e,f,g,i,h]
26. [j,i,h,e,f,g]
27. [g,i,h,e,f,g]
28. [i,h,e,f,g,i]
29. [l,m,n,o,l]
30. [m,n,o,l,m]
31. [o,l,m,n,o]
32. [n,o,l,m,n]
33. [m,n,o,l,p]
34. [e,f,h,e]
35. [f,h,e,f]
36. [l,m,o,l]
37. [m,o,l,m]
38. [o,l,m,o]
39. [m,o,l,p]
40. [h,e,f,h]
41. [j,i,j]
42. [i,j,i]
43. [b,c,b]
44. [a,b,c]
45. [c,b,c]

## Assignment 6



c) 3 test paths are needed for Node Coverage

[a,b,c,b,d,e,k,l,p]

[a,b,d,e,k,l,m,n,o,l,p]

[a,b,d,e,f,g,i,j,i,h,e,k,l,p]

Missing edges: [f, h] [m,o]

The following two paths are needed to complete the missing edges.

[a,b,d,e,f,h,e,k,l,p]

[a,b,d,e,k,l,m,o,l,p]

d) 3 test paths are needed for Edge Coverage

[a,b,c,b,d,e,f,g,i,j,i,h,e,k,l,m,n,o,l,p]

[a,b,d,e,f,h,e,k,l,p]

[a,b,d,e,k,l,m,o,l,p]

The above test paths together achieve the edge coverage but cannot achieve the prime path coverage.

There are many missing prime paths like [c,b,d,e,k,l,m,n,o]