ECE 322

SOFTWARE TESTING AND MAINTENANCE

Fall 2025

Assignment #6

Solutions

Due date: Monday, December 1, 2025 by 3:00 PM

Total: 30 points

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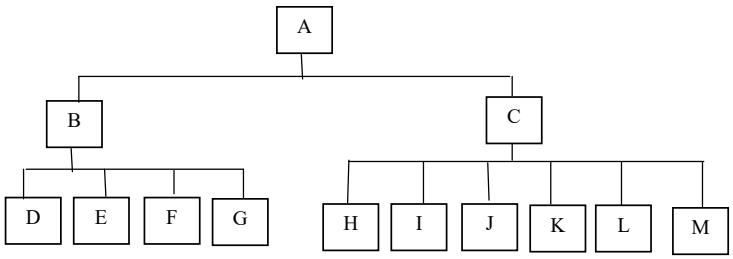
10 points

1. (a)What strategy of integration testing would you recommend for the software system whose dependency tree for the modules is shown below? The system is developed in an unstable environment.



Solution: Top-down because of the existence of the unstable environment. This strategy makes sense as it could well be that some detailed design aspects are not fully addressed at the beginning phase and postponed to the later stage.

(b) Identify the number of paths in the following control flow graphs with loops. What is the relationship between *p* and *r* so that the number of paths in Fig.1 (a) is smaller than in case of Fig. 1(b)

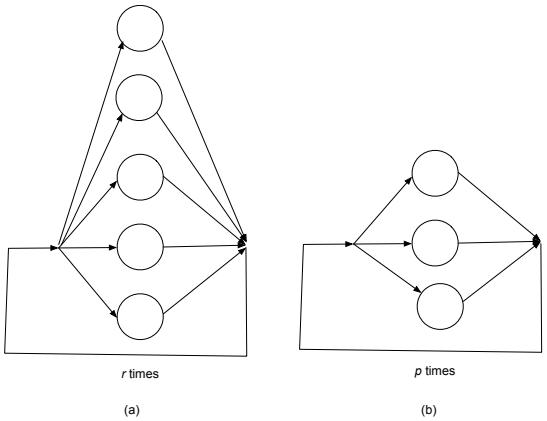


Figure 1.

Solution

For (a) we have 5^p paths. For (b) there are 3^r paths so we require that $5^p<3^r$ meaning that $p\log(5)<r\log(3)$ and $r>p\log(5)/\log(3)$.

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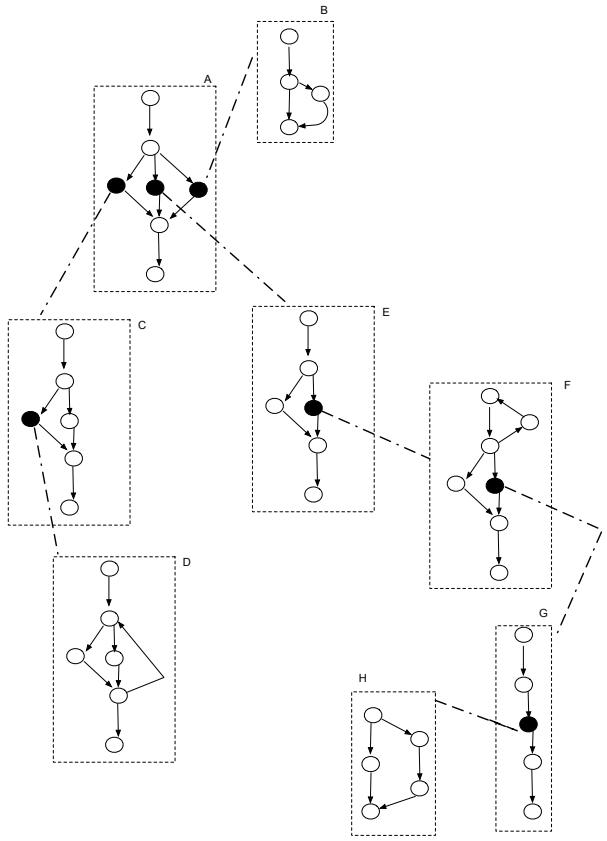
10 points

2. What is the cyclomatic complexity and integration complexity of the software modules displayed below. Determine complexity of integration testing. List independent integration tests.



Solution

- G(A) = 3, iv(A) = 3
- G(B) = 2, iv(B) = 1
- G(C) = 2 iv(C) = 2
- G(D) = 3, iv(D) = 1
- G(E) = 2, iv(E) = 2
- G(F) = 3, iv(F) = 2
- G(G) = 1, iv(G) = 1
- G(H) = 2, iv(H) = 1

So, the integration complexity is 13 – 8 + 1 = 6.

The integration tests are:

- A → B ← A
- A → C ← A
- A → C → D ← C ← A
- A → E ← A
- A → E → F → G → H ← G ← F ← E ← A
- A → E → F ← E ← A

10 points

3. Given is some square matrix *A*. Propose a metamorphic relation to carry metamorphic testing of matrix inversion.

Solution
There are a number of possibilities. An example:

$R(A, B, f(A), f(B))=\{A, B=kA, k$ -different from 0 $| f(A)=k^{-1}f(B)\}$ where $f(A)= A^{-1}$