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CSCI 338 Computer Science Theory
Test 1 — 55 minutes (10 points)

Question 1

- **F**
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- **F**

Question 2

By definition, a forest F is an undirected graph in which any two vertices are connected by at most one path. We will prove that a forest F is composed of r trees with a total of n vertices such that F has n - r edges. This proof will be done by induction. Let us assume that the total number of vertices n is equal to 1.

Base case: n = 1

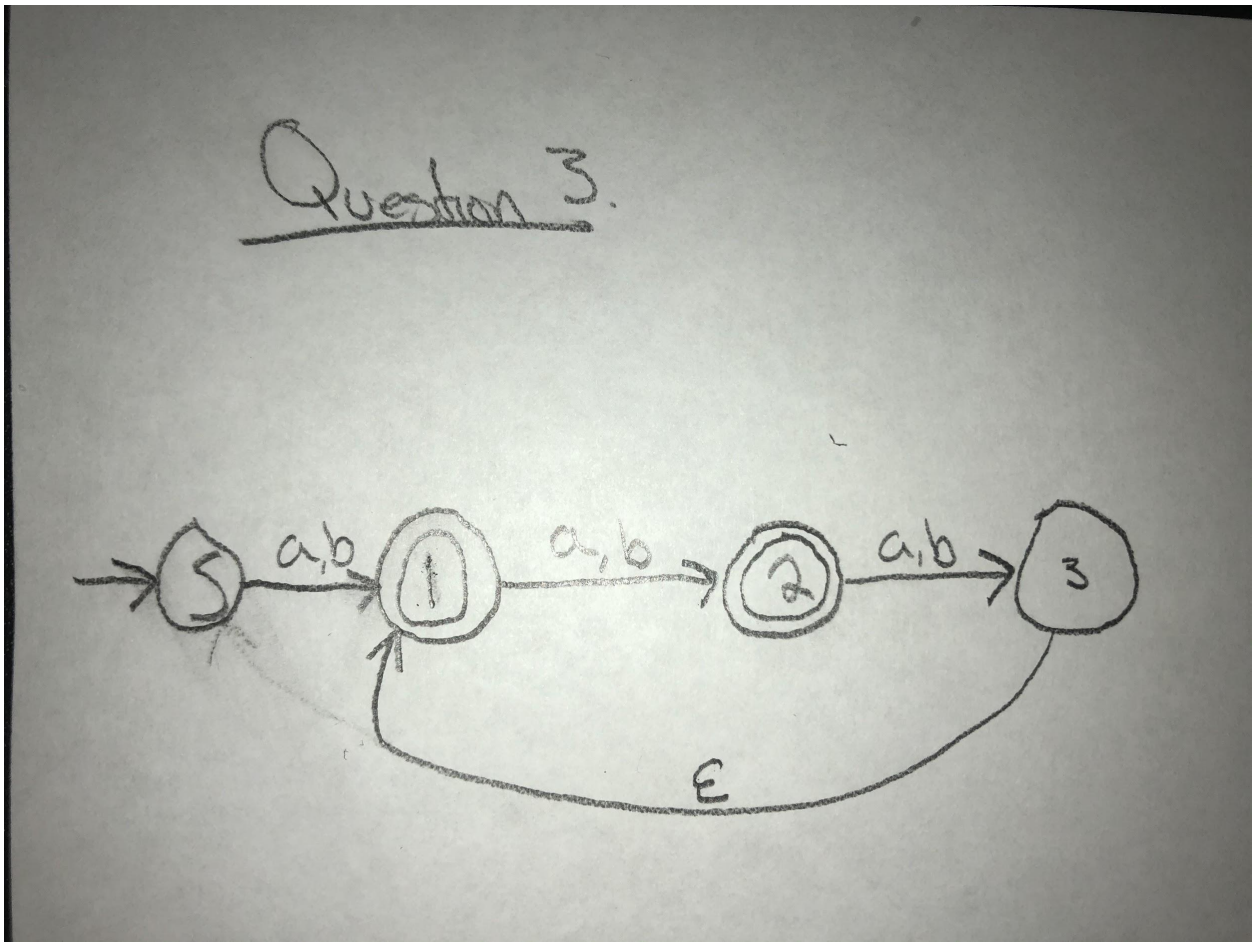
In the base case, there is only one such tree, r = 1, and one isolated vertex, n = 1. Thus, 1 - 1 = 0, hence a single isolated vertex does not have any edges. Therefore, the base base is proven to be true.

Inductive Step: Assume that the number of edges in the forest F is also true for vertices n, such that n >= 2 and that the base, n = 1 is also true.

- Let v be any leaf in the forest F
- By removing leaf v from forest F, and there by removing its unique edge which connects it to the tree, we now have a new forest H.
- H must be connected such that no cycles exist
- With the removal of a leaf, we also lose an edge
- Then G has (n-2) +1 = n - 1 edges

Therefore, any forest F has n - r edges.

Question 3



Question 4

Let’s assume that B is a regular language. If B is Regular, then by definition, there must exist some pumping length p for a substring s in B that can be pumped such that |s| >= p.

All possible string from language B are some multiple of a factorial of a. Thus, by decomposing s into x y^i z, By 3 |y| <= p. But is y substring begins at index 0 and x is an empty set, this is a contradiction to rule 3.