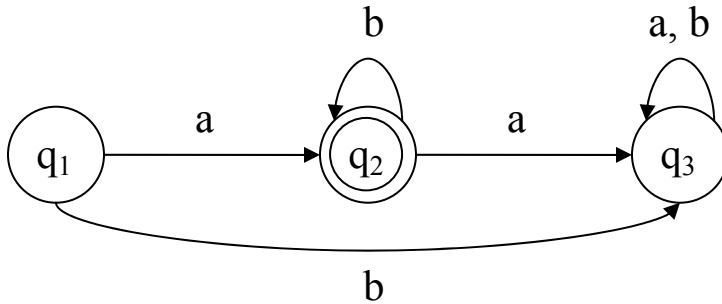


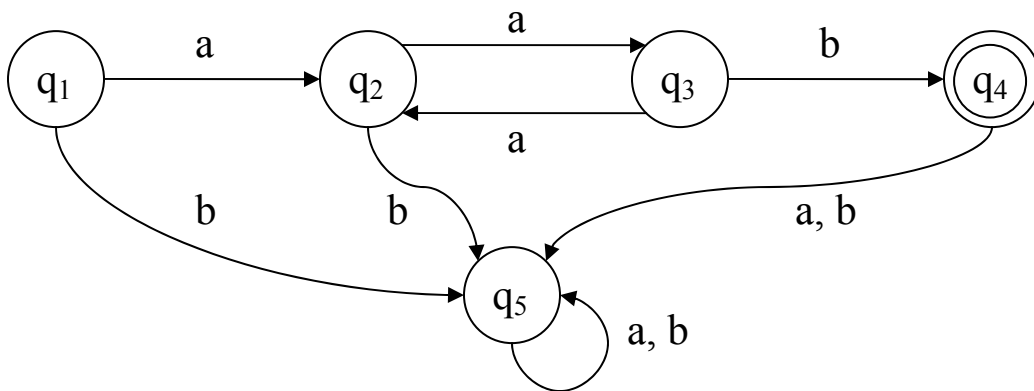
## Assignment #3 – Sample Solutions

### Question 1:

a) Draw a finite automaton that accepts the language  $L = \{a, ab, abb, abbb, abbbb, \dots\}$



b) Draw a finite automaton that accepts the language  $L = \{aab, aaaab, aaaaaab, \dots\}$



c)

Possible answer 1:  $L = \{a^{[n]}b^{[m]} \mid n \geq 0, m \geq 1\}$

Possible answer 2: The machine accepts all strings that start with a sequence of zero or more a's, followed by a sequence of one or more b's..

**Question 2:**

At a tennis tournament there is a pile of eight tennis balls. All of them look identical, but one of them is slightly heavier or lighter than the other ones. You can use a balance to compare the weight of two different groups of tennis balls. Draw a decision tree to find the odd ball with a minimum number of weighings.

The best way to do this may be to assign numbers 1 to 8 to individual balls. Then you could describe each weighing by giving two sets of numbers. For example, “1,2,3 – 4,5,6” means that you put balls number 1, 2, and 3 on the left side of the balance and balls number 4, 5, and 6 on its right side. From each weighing, up to three branches will extend downwards, corresponding to the three possible outcomes: (1) the left side is heavier, (2) the right side is heavier, or (3) they are equally heavy.

**Answer:** The algorithm represented by the decision tree below guarantees the detection of the odd ball within no more than three weighings. L, S, and R means left side heavier, same weight, and right side heavier, respectively. Circled numbers indicate the number of the odd ball as determined by the algorithm.

