Minia University
Faculty of Engineering
Computers and Systems Engineering Department

Course: System Analysis (CSE314)

Date: 24/11/2019 **Midterm Exam 1** **Total:** 30 marks **Time:** 1.5 hour

Attempt the following questions:

Question (1): (10 marks)

1. Define the following sets using formal mathematical notations:
   a) The set of all integers which are divisible by 4.
   b) The set of all natural numbers which are also prime numbers.
2. Give an example of a system H that takes the function in the specified domain as input and produces functions in the specified domain as output.

$$H: [\mathbb{R} \to \mathbb{R}] \to [\mathbb{N}_0 \to \mathbb{R}_+]$$

where $\mathbb{R}$ is the set of real numbers, $\mathbb{R}_+$ is the set of positive real numbers, and $\mathbb{N}_0$ is the set of natural numbers including zero.

Question (2): (10 marks)

Consider the state machine in Figure 1 with all the possible inputs and outputs are shown on the diagram. Ignore the absent input, absent output, and stuttering reaction.

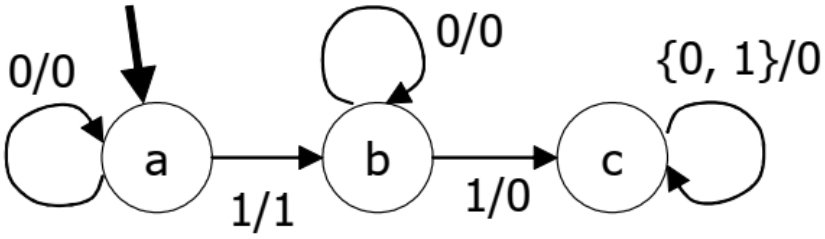

Figure 1

1. Write the 5-tuple model for the state machine. You may specify update using a table if you wish.
2. Consider an input sequence x which fits the pattern $x = 0^k 1^m *^n$ where $*$ can be a 0 or a 1. What is the corresponding output sequence y?

Question (3): (10 marks)

For the considered the state machine above in Figure 1:

Cascade the state machine with itself, then list the unreachable states in the resulting composition.