

EE1009-Digital Logic Design

Spring 2024 (Design)

Problems

Question 1:

FAST-NUCES is announcing a scholarship program for the students of engineering and computer science. For this purpose three different modular exams would be taken.

If any student wants to get this scholarship he/she should pass all three exams. In the first exam there are three questions and each question has two parts. If any one part is correct that question would be considered correct. If all three questions are correct then that exam would be considered PASSED.

Now after the passing of first exam, he/she would be allowed for the second exam. There are two questions in the second exam. If both the answers are correct then only the exam would be considered PASSED.

Now after passing of second exam, he/she would be allowed for the third exam. There are three questions in this exam. All correct answers are required to pass that exam, and then he/she can get the scholarship.

Design a logical circuit for the above scenario

Question 2:

An electronic system will only operate if three switches P, S and T are correctly set. An output signal ($X = 1$) will occur if R and S are both in the ON position or if R is in the OFF position and S and T are both in the ON position. Design a logic circuit and write the Logic notation to represent the above situation and draw the truth table?

Question 3:

A traffic light system uses logic gates as part of the control system. The system is operated when the output D has the value 1. This happens when: either (a) signal A is red or (b) signal A is green and signals B and C are both red (NOTE: You may assume for this problem that red = 0 and green = 1). Design a logic circuit and write the Logic notation to represent the above situation and draw the truth table

Question 4:

Description:

An alert will be displayed when certain conditions occur in a nuclear reactor.

Conditions:

The output, X, of a logic circuit that drives the display of the alert must have a value of 1 when either one of the conditions is met:

- carbon dioxide pressure too low and temperature > 300°C
- water pressure > 10 bar and temperature > 300°C

Inputs (inputs can be increased or reduced based on the scenario):

The inputs to the system are:

Input	Binary	Condition
P	0	carbon dioxide pressure acceptable
	1	carbon dioxide pressure too low
T	0	temperature <= 300°C
	1	temperature > 300°C
W	0	water pressure <= 10 bar
	1	water pressure > 10 bar

Draw the logic circuit and truth table of the system

Question 5:

Comparison of 2-bit binary number?

Question 6:

A nuclear power station has a safety system based on three inputs to a logic circuit. A warning signal ($S = 1$) is produced when certain conditions in the nuclear power station occur based on these three inputs.

Inputs	Binary values	Description of plant status
T	1	Temperature > 115°C
	0	Temperature <= 115°C
P	1	Reactor pressure > 15 bar
	0	Reactor pressure <= 15 bar
W	1	Cooling water > 120 litres/hour
	0	Cooling water <= 120 litres/hour

A warning signal ($S = 1$) will be produced when any of the following occurs:

either (a) Temperature > 115°C and Cooling water <= 120 litres/ hour
or (b) Temperature <= 115°C and Reactor pressure > 15 bar or
Cooling water <= 120 litres/hour

Draw a logic circuit and truth table with logic notation to show all the possible situations when the warning signal (S) could be received.