# Department of Computing
Course 112 - Hardware
Tutorial 3

This tutorial contains exercises that are assessed. Make certain that your name, initials and group are clearly filled in. Do all your work on this sheet and hand it in at the end of the tutorial session.

LAST NAME_____INITIALS_____GROUP_____

1.a. A "badly designed circuit" is shown below. Determine its truth table and fill in the K-Map. Note that some entries in the truth table can be filled in by inspection. If A=1 for example then R will be always 0 (why?). Also, if B=0 then the output will be equal to A' (why?).
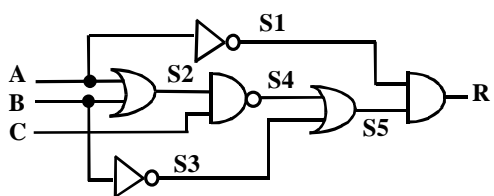
A B C	S1	S2	S3	S4	S5	R
0 0 0						
0 0 1						
0 1 0						
0 1 1						
1 0 0						
1 0 1						
1 1 0						
1 1 1						

BC

	0 0	0 1	1 1	1 0
A 0				
1				

.

1.b. What is the Karnaugh Map minimized expression for this circuit?

      R = _____

1.c. Draw the circuit:

1.d. What would be the minimum implementation if we knew that the input pattern **011** would never occur? (Modify the K-Map to include "don't cares"). Determine the minimum expression and draw the circuit.

BC

	0 0	0 1	1 1	1 0
A 0				
1				

      .   .

      R = _____

2.a. The truth table of a four-input one output digital circuit is shown below. Fill in the Karnaugh map, find the minimum expression for it, and draw the circuit.

A	B	C	D	R		A	B	C	D	R
0	0	0	0	1		1	0	0	0	1
0	0	0	1	1		1	0	0	1	1
0	0	1	0	1		1	0	1	0	1
0	0	1	1	1		1	0	1	1	0
0	1	0	0	0		1	1	0	0	0
0	1	0	1	1		1	1	0	1	1
0	1	1	0	0		1	1	1	0	0
0	1	1	1	0		1	1	1	1	0

CD

		00	01	11	10
AB	00				
	01				
	11				
	10				

.   .

3. (optional)

A circuit is designed for binary coded decimal input processing. This means that four bits are used for input but only **ten** of the possible sixteen input combinations are used. (There are **six** don't cares). The circuit output is a **1** whenever there are exactly three inputs at **Logic-1** and the remaining input is at **Logic-0**. Find the minimum circuit.

.   .

CD

		00	01	11	10
AB	00				
	01				
	11				
	10				