

Homework #6  
Due We. 10/21

**Note:** Do not use a calculator or computer to complete the following exercises. You must show all your work and put a box around your final answer to receive credit. Messy or unreadable submissions will receive no credit.

Homework will only be accepted at the beginning of class and all pages must be stapled together.

**Total Points:** 91

1. (0 points) How long did it take you to complete the homework? This will not affect your grade (unless omitted) but it helps gauge the workload for this and future semesters. If you do not answer this question you will get -5 points.
2. (12 points) Use a Karnaugh map to minimize the following functions. Assume Y is the output and all other variables are inputs and express your final answer in minimized SOP and POS form.

(a) (6 points)

A	B	C	Y
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

(b) (6 points)

A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

3. (19 points) Use a Karnaugh map to minimize the following functions. Express the output in minimized SOP form only. The terms in parenthesis indicate the input variable names.
  - (a) (3 points)  $F(A, B, C) = \sum m(1, 5) + \sum d(2, 7)$
  - (b) (3 points)  $G(A, B, C) = \sum m(0, 2, 4) + \sum d(1, 3)$
  - (c) (8 points) Construct a truth table which encodes each month in its natural binary encoding (e.g. 0000 = January, 0001 = February, etc.). The boolean output signal  $H$  is considered true if the month contains a school holiday. Use only the following list of “official” holidays (Labor Day, Nevada Day, Veterans Day, Thanksgiving, Washington’s Birthday (February), and Spring Break (March)). Find the simplified expression making use of “don’t cares” where appropriate.
  - (d) (5 points)  $J(A, B, C, D, E) = \sum m(0, 3, 4, 7, 8, 12, 14, 16, 19, 20, 23, 24, 26, 28)$
4. (60 points) Hand’s On Design

In this problem, you will use the Quartus II Web Edition v13.1 software to design and simulate digital circuits since it is a powerful and popular commercial suite used by hardware designers and other CPE courses. You should already have either i) installed the software on your own computer or ii) gone onto the ECE Lab computers in TBE-B 311 or 350 with your ACE account to use pre-installed version.

For instructions see [\[link\]](#).

Your homework solution should include answers to the following below.

- (a) (5 points) Give a minimized SOP form of equation for output  $Y$ .
- (b) (5 points) Give the truth table showing the  $Y$  output.
- (c) (5 points) Draw a hand sketch of your **neat** circuit schematic. (E.g. two-level circuit schematic).
- (d) (20 points) Give printout of Quartus II schematic of circuit.
- (e) (20 points) Give printout of ModelSim simulation of circuit. Be sure to test the circuit in counting order (i.e.  $ABC = 000, 001, 010, \dots, 110, 111$ ) and list your signals in the following (top-to-bottom) order  $A, B, C, Y$ .
- (f) (5 points) Write a brief paragraph (2-4 sentences) saying what you learned doing the hands on work.