CSC 156 Midterm

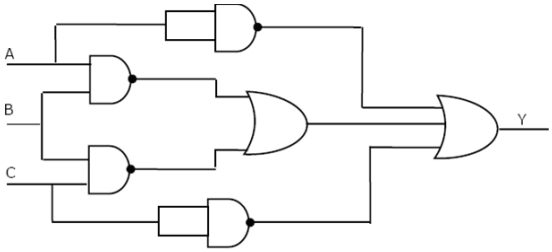
Due Tuesday, April 4 in class

Guidelines for the exam. Failure to meet these guidelines will result in a decreased grade.

- You must work completely on your own, no partners. If you have questions, you can come to my office hours or ask me via e-mail.
- You are allowed to use any resource you wish. But if you use a resource not from class (i.e. Google) then you must cite your reference. Failure to sight your reference will result in a zero on the exam.
- Show all of your work. Just an answer will not suffice.
- Solutions should be written neatly with no scratching out of work.
- There should only be one solution on a given page. This means you will be turning in at least 10 pages. If there are two solutions on a given page, then I will only grade one.
- No perforated edges.
- Do not staple your exam. A paper clip is fine, but I will be scanning these exams and I don't want to mess with staples.
- Use words and complete sentences when answering questions.

There are 10 questions for a total of 100 points. Good luck!

1. (10 points) Convert the 321 in base ten to binary, base 8, and hexadecimal. (Don't forget to show your work)
2. (10 points) Given the 8 bit string $b = 01100100$, what 8 bit number c is such that $b + c = 00000000$? (Don't forget to show your work)
3. (10 points) Show the following logical equivalence: $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$.
4. (10 points) For the logical circuit below, what is the output Y?



5. (10 points) What is an algorithm? Give three examples.

6. (10 points) Consider the following sequence:

$$1, 11, 21, 1211, 111221, 312211, 13112221, 1113213211, \ldots$$

This is called the Look-and-say sequence (it's okay to look this up, spend 5 minutes trying to figure out the pattern though). Using pseudo-code, write an algorithm that will print the first 1000 terms.

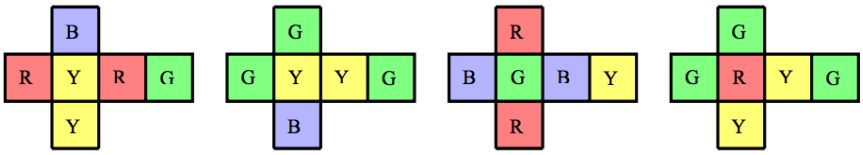
7. (10 points) IT is in the process of installing a fiber optic cable network at our campus. There are 7 buildings to connect and they labeled them a, b, c, d, e, f, and g. Below is a chart that describes the cost (in thousands of dollars) of installing a cable between the buildings. For example, it costs \$20,000 to install a cable from building 'a' to building 'b'. Find the minimum cost that IT needs to budget in order to connect all of the buildings together. (Don't forget to explain your answer)

	a	b	c	d	e	f	g
a	0	20	27	51	40	25	46
b	20	0	22	44	30	34	52
c	27	22	0	42	15	10	53
d	51	44	42	0	50	37	57
e	40	30	15	50	0	17	55
f	25	34	10	37	17	0	54
g	46	52	53	57	55	54	0

8. (10 points) Go online and find 2 applications of the vertex cover problem. You need to explain the applications with examples. Don't use more than one side of a page per example. (You should use at least half a page per example though.)

9. (10 points) Let G be a simple graph with edges $e_1, \ldots, e_m$. The *line graph* $L(G)$ is the simple graph with vertices $v_1, \ldots, v_m$ such that v_i is adjacent to v_j if and only if the edges e_i and e_j are adjacent in G. Draw the line graph of K_4 and the line graph of $K_{2,3}$.

10. (10 points) Consider four cubes whose faces are colored red, blue, green, and yellow as in the following diagram:



(Note: These cubes are colored differently than the ones from class.) Find a way to stack all four cubes so that all four colors appear on each side of the resulting stack.