Homework 2

BASICS OF COMPUTING
(CSCE 101, SPRING 2007)
URL: `http://my.unl.edu`

Due on 20th February, 2007

1st February, 2007

Name :
Course No : **CSCE101**

Instructions:

- All work must be written neatly, with answers and the steps you used to obtain the answer clearly marked. If the grader cannot understand how you obtained your answer, points will be deducted. If your answers take more than one page, **staple** your homework. Failure to do so may result in portions of the homework being lost.
- You must **show all steps of your work for full credit**. Do not simply write final answers for a problem if it involves intermediate steps. In most cases, you will show your work in the same manner that you would for a math class. Writing a short essay describing how you solved the problem is unnecessary.
- The only way to submit your homework is in class at the beginning of the class when it is due.

1. (6 points) Enumerate both the smallest and largest **non-negative** numbers representable in 8-bit Floating Point Notation, and translate them into their decimal values.

Smallest:	Largest:

2. The following problems are from J. Glenn Brookshear, p. 71: *(For all problems, draw the circuits in the space provided.)*

   1.1 (6 points) Do problem 1. On the right side of the circuits, write the truth table for each circuit.

   a.

   b.

   c.

   1.2 (6 points) Do problem 2.

   a.

   b.

   c.

1.3 (6 points) Do problem 3. *(There may be more than one correct answer!)*

a.

b.

c.

1.4 (6 points) Do problem 4.

3. (4 points)

   (a) Identify two advantages that main memory has over magnetic disk storage.

   (b) Identify two advantages that magnetic disk storage has over main memory.

4. (5 points) How long is the latency time of a typical hard-disk drive spinning at 60 revolutions per second?

5. (5 points) A particular floppy disk drive spins at a rate of 300 revolutions per second. In addition, it takes 10 ms (milliseconds) on average to position the read/write head above a desired track. What is the access time for this disk drive? (1 ms = 0.001 seconds)

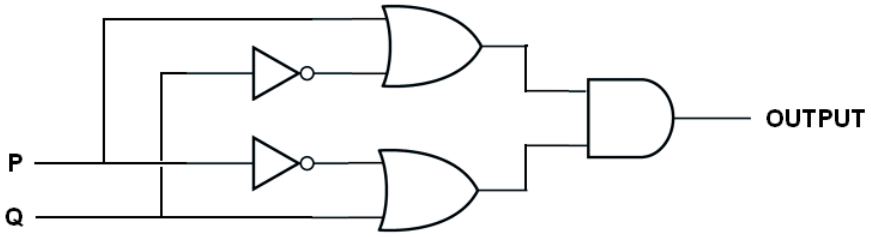
6. (5 points) If each sector on a magnetic disk contains 1024 bytes, how many sectors are required to store a single page of text (50 lines of 100 characters) if each character is represented in Unicode?

7. (5 points) Why is magnetic tape not a good choice for storing data that you need to access often?

8. (12 points) To the right of the truth table, write the logical statements (using AND, OR, and NOT) for each of the rows where `O` is true. Below, draw the circuit that corresponds to your logical statements:

A	B	C	O
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

9. Consider the logic circuit shown in the figure below:

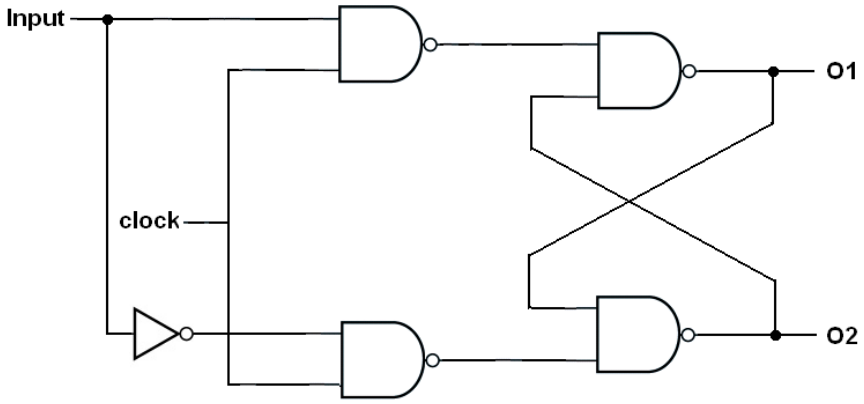


(a) (4 points) Write the truth table for the circuit.

(b) (3 points) As you can see, we use five logic gates to build this circuit. To reduce the cost of manufacturing it, we would like to reduce the number of gates that are used in the design, while preserving the same functionality of the circuit. It turns out that we can replace the five logic gates shown in the box by a single gate that does the same function. What is this single gate?

(c) (3 points) One advantage of replacing the overall circuit with a single gate is to reduce the cost of the circuit. Give another advantage of such a design other than the cost.

10. Consider the logic circuit shown below:



Suppose that, initially, the inputs and outputs of the above circuit are as follows: `Input` = 1, `clock` = 1, `O1` = ?, `O2` = 0. Answer the following questions:

(a) (2 points) What is the initial value of `O1`?_____

(b) (8 points) Answer the following questions, assuming that the state remains as above for each question:

i. If the value of the `clock` becomes 0, and the value of `Input` is still 1, what are the values of both `O1` and `O2`?

O1: _____

O2: _____

ii. If the value of the `Input` becomes 0, and the value of `clock` is still 1, what are the values of both `O1` and `O2`?

O1: _____

O2: _____

(c) (4 points) Under what conditions will the output of this gate be allowed to change?

11. (10 points) Suppose you have a "black box" (below) that has two inputs, A and B, a control signal, and an output called OUT. You want to design the logic circuit in the black box such that when the control signal is 1, the output of the black box is the same as A (OUT = A), whereas when the control signal is 0, the output of the black box is the same as B (OUT = B). Neatly draw the logic circuit in the figure below.