First Midterm Exam (b) MCS 260 Jan Verschelde Friday 26 February 2016

NAME : ***answers***

The exam is closed book, no notes and no computer.
All your answers to the questions below must be submitted on paper.
Write your name on this sheet and submit it with your answers.
Please do not ask questions during the exam.

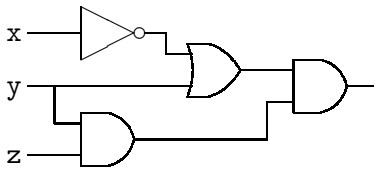
1. Convert the decimal number 129 into binary notation. Show your work.

   answer: $129 = 8 \times 16 + 1$, so $129_{10} = 1000\ 0001$.

2. Who was Ada Lovelace? Explain briefly her contribution to computer science.

   answer: Ada Lovelace was a mathematician who wrote a diagram to compute Bernoulli numbers by the Analytical Engine of Charles Babbage.

3. Consider the circuit:

   Write the logical expression represented by the circuit: `(not x or y) and (y and z)`

4. Consider the list `L = ['a', 'd', 'f', 'g' , 'o', 'r', 'u']` of sorted strings. Inserting a string `x` into `L` so the list `L` remains sorted requires the finding of the index of the first element in `L` that is larger than or equal to `x`.

   (a) Consider `x = 'm'` and let `index` denote the current index in the list `L`. Initially when we start the search, `index` equals 0. The state table of the loop starts as

step	`index`	`L[index]`
0	0	`'a'`

   Complete this table, taking one row per step, until `L[index] >= x`.

   (b) Write Python code for the loop to find `index` so `L[index] >= x`.

answer:

(a) The state table:

step	`index`	`L[index]`
0	0	`'a'`
1	1	`'d'`
2	2	`'f'`
3	3	`'g'`

(b) The Python code:

```
index = 0
while L[index] < x:
    index = index + 1
```

5. Consider the list `vowels = ['a', 'e', 'i', 'o', 'u']` and the string `word`.
   Write a list comprehension to count the number of vowels in the `word`.
   For example, the word `"queueing"` has five vowels.

   answer: `sum([c in vowels for c in word])`

6. What is Linux? Explain the difference with UNIX.

   answer: Linux is a free and open source operating system.
   Linux resembles UNIX, but UNIX is not free and open source.

7. Consider the code below:

```
def vol(b, h):
    v = h*b**2
    return v

(a, k) = (1, 2)
V = vol(a/2, k)
```

Answer the following questions:

(1) Which variables are global? `a, k, V`

(2) Which variables are local? `v`

(3) What is the type of `V`? `float`

(4) Fill the table with values for `b`, `h`, `v`, `a`, `k`, and `V`.

	b	h	v	a	k	V
before the call to `vol(a/2, k)`				1	2	
during the call, just before `return v`	0.5	2	0.5	1	2	
after the call to `vol(a/2, k)`				1	2	0.5