NAME: ANSWERS

Closed book. No calculators, no computer.
Write all answers on these sheets. Do not ask questions!

<table>
<thead>
<tr>
<th>question</th>
<th>1</th>
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<tbody>
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<td>points</td>
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<td>maximum</td>
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<td>20</td>
<td>15</td>
<td>10</td>
<td>100</td>
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1. What is a register?

* A register is a memory element which can be read from or written to very quickly, located in the CPU.

2. View A4 as a number in the hexadecimal system. What is A4 in the decimal system?

* \( A_{16} = 10_{10} \)
  * A evaluates to 10 in the decimal system.
  * \( A4 = 10 \times 16 + 4 = 164 \).
3. Consider the circuit drawn below:

(a) For $x = 1$ and $y = 0$, what is the outcome of this circuit? **ANSWER: 1**
Mark the results on the circuit drawing above.
(b) What is the logical expression that represents this circuit?

$$ (x \text{ AND } y) \text{ OR NOT } y $$

4. Given in $n$ is a natural number which represents time in a 24 hour format. Write Python code to print the corresponding time in AM/PM format. Some examples: 845 = 845 AM, 2045 = 845 PM, and 1221 = 1221 PM.

```python
if n < 1200:
    print '%d AM' % n
elif n < 1300:
    print '%d PM' % n
else:
    print '%d PM' % (n - 1200)
```
5. Consider the flowchart:

(a) What expression does the algorithm in the flowchart compute? (Do NOT evaluate the expression into one number.)

\[
s = \sum_{k=0}^{9} 2^k
\]

(b) Write Python code to implement the algorithm.

```python
s = 1
p = 2
k = 0
while k < 9:
    s = s + p
    p = p * 2
    k = k + 1
print s
```

or alternatively

```python
s = 1
p = 2
for k in range(0, 9):
    s = s + p
    p = p * 2
print s
```
6. The length of a vector with coordinates \((v_1, v_2, v_3)\) is \(\sqrt{v_1^2 + v_2^2 + v_3^2}\).

Write a Python function (call it \texttt{length}) which takes on input the coordinates of a vector and returns the length of the vector. Make sure the function works also for planar vectors, so the user can enter only two coordinates.

```python
def length(v1,v2,v3=0):
    import math
    s = math.sqrt(v1**2 + v2**2 + v3**2)
    return s
```

7. Give the Python commands to generate a random 10-letter word.
   Use \texttt{random.randint()} to uniformly generate letters.
   The final result is a string of 10 characters.

```python
import random
r = range(0,10)
u = lambda i: random.randint(ord('a'),ord('z'))
N = map(u,r)
L = map(chr,N)
s = reduce(lambda x,y: x+y,L)
```