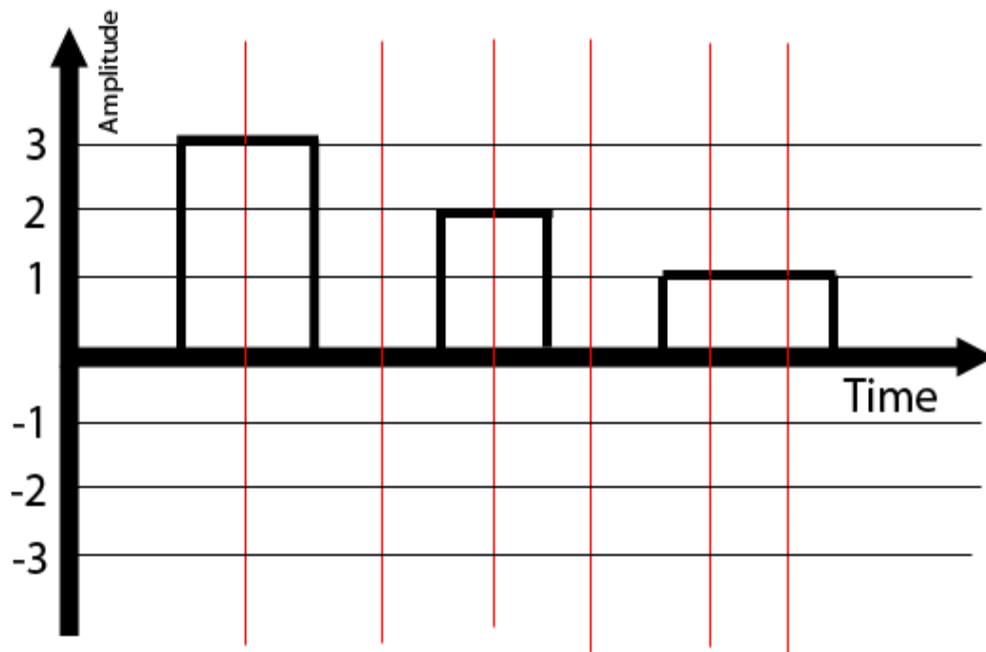# *Midterm*

COS 116 Spring 2011: The Computational Universe

This is an in-class exam. No collaboration is allowed. Write and sign the honor pledge:

"I pledge my honor that I have not violated the Honor Code during this examination."

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1) Sampling

Assume that this square wave is being sampled at each moment in time that is marked with a vertical line. Label each sample with a 4-bit sequence (i.e. 0000) corresponding to the amplitude at that time.

2) Scribbler Pseudocode Errors

This code should cause the scribbler to move forward indefinitely, spinning right when an obstacle is detected (then continuing to move forward).   What's wrong with it? (cross out any incorrect portions and write corrected code)

Do once
{
   If <No Obstacle> Then
  {
     Move <Left Wheel Speed 100%, Right Wheel Speed 100%> for 0.2s
  }
  Else
  {
     Spin Right for 0.3s
  }
}
END

The following code should cause the LEDs on the scribbler to blink on and off repeatedly. What's wrong with it?

Do forever
{
  LED: ON, ON, ON
  LED: OFF, OFF, OFF
}
END

3) Pseudocode Output

```
Do for i = 1 to 20
{
    If ( i > 15) then
    {
            If( i < 20)
            {
                    Print(i)
            }
    }
}
```

What output does the code above produce?

Tests knowledge of for loop and nested if clause. Answer is "16,17,18,19".

4) **List 3 essential features of a cellular automaton**

5) **Assume the following Truth Table:**

E	D	S
True	True	True
True	False	False
False	True	False
False	False	True

Write a Boolean expression representing this Truth Table.

Draw a Boolean circuit represent the Truth Table above.

E = (S AND D) OR (NOT S AND NOT D)

6) Recall the "findmin" example shown in class:

```
best ← 1
Do for i = 2 to n
{
    if ( A[i] < A[best] ) then
            best ← i
}
```

Why does the for loop start at 2?

Because we are assuming the first element in the array holds the smallest value, then comparing that value to all others in the array.

Is it OK if we start the loop at 1 instead? (Do for i = 1 to n) Why?

Yes, the first iteration of the loop will simply do nothing.

7) What does the following code do?

```
S ← 0
Do for i = 1 to [n/2]
{
    S ← S + A[2*i];
}
```

A sum of all even-indexed elements except 0 in the array (i.e. A[2], A[4], A[6]...)

8) Will the following Turing Post program print 101? If not, how can you fix it?

```
PRINT 1
PRINT 0
PRINT 1
STOP
```

You need "GO RIGHT" after each of the first two print statements.