Midterm Exam

Wednesday 9 March 2011

1. For each statement below, fill in the blank with the *best* term from the following list. Some terms might be used more than once; some might not be used at all.

   • algorithm • ASCII • bit • Boolean • byte • hexadecimal • pixel • pseudo-code • unicode

   (a) _____ is a numbering system in which each digit represents four bits.

   (b) _____ is a binary encoding of characters from most of the world's languages.

   (c) A(n) _____ is a procedure for solving a particular problem in a finite number of steps.

2. Write down the decimal (base 10) equivalents for the following 5-bit signed (two's complement) binary numbers. (That means the answers might be negative!)

   `0 1 0 1 1 =` _____ `1 0 0 1 0 =` _____

   `0 1 1 0 1 =` _____ `0 1 1 1 1 =` _____

   `1 0 0 0 1 =` _____ `1 1 1 1 1 =` _____

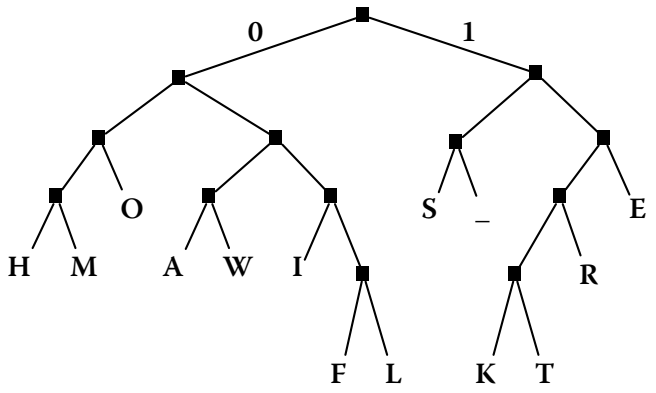
3. Add the following pairs of binary numbers. Your answers must be in binary, but you may wish to check your work by converting to decimal.

```
  0 1 0 1 0        1 0 0 0 1        0 1 1 0 1
+ 0 0 0 1 1      + 0 0 1 1 1      + 1 0 1 1 1
------------     ------------     ------------
```

4. Complete the following truth table. Add any extra columns you might need to compute intermediate results.

A	B	C	A and (B or C)	B and (A or C)

5. Below is a tree representing a variable-width encoding.



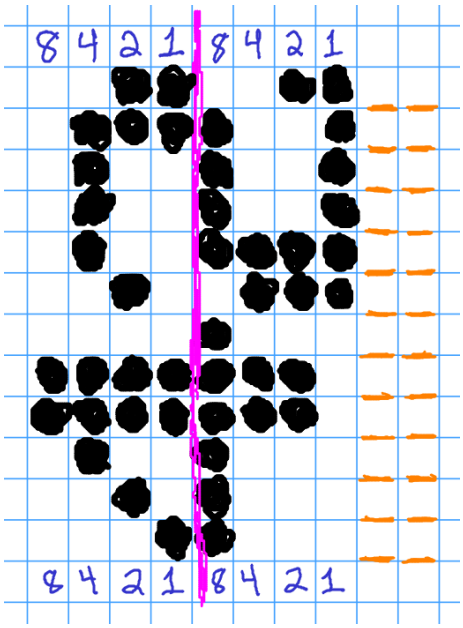
(a) Use the tree to encode the following message in binary:

```
T    R    E    E    _    F    L    O    W
```

(b) The tree contains 14 distinct characters. If we were using a *fixed-width* encoding of the same characters, how many bits per character would we need? _____

(c) The message in part (a) is 9 characters. How many bits did we save by using a variable-width encoding instead of a fixed-width one?_____

6. The following grid contains some pixels representing the score in a video game (turn it sideways). Encode the graphic in hexadecimal notation, using 1 bit per pixel.



7. Explain the key organizing principle of the *memory hierarchy*. Include some examples of different kinds of storage, as well as the definitions of *persistent* and *volatile*.

8. What is the output of the following Python program?

```
frodo = 8
bilbo = frodo - 3
print "bilbo"
bilbo = bilbo + frodo
print bilbo+1
```

9. What is the output of the following Python program?

```
lois = 5
peter = 6
stewie = lois + peter
if lois > peter:
    print "YES"
lois = lois + 4
if lois > peter:
    print "NO"
stewie = 9
if stewie > lois:
    print "MAYBE"
print stewie - lois
```