ECE 250
Data Structures and Algorithms
QUIZ 1
2006-10-02

The quiz is out of 20 marks.
No questions, no aides.
If you are unsure about a question, write down your assumptions and continue.
This examination has two pages of questions.

Surname, Given Name				Student ID	
1.	2.	3.	4.	5.	B.

_____
Sign here indicating that you have read the above instructions.

1. **[2]** If $\log_2(1000) = 9.96$, what is $\log_{16}(1000)$?

2. **[4]** Using limits and l'Hopital's rule, determine which Landau symbol best describes the relationship $n^{3/2} = \mathbf{X}(n \ln(n))$ where $\mathbf{X}$ may be one of $\mathbf{o}$, $\mathbf{O}$, $\mathbf{Q}$, $\mathbf{W}$, or $\mathbf{w}$. Show your work.

3. **[5]** Each of the data sets listed in Table 1 may be described as partially-ordered data which may also be represented as a tree structure. Place a check mark under the appropriate column as to whether there is a unique root to the tree or if there are multiple roots.

Marking:
      +1 for each correct answer
       0 for each blank
      −1 for each incorrect answer
with a minimum of **0**.

Table 1. Partially ordered data sets.

	Single Root	Multiple Roots
Unix directories		
DOS directories		
An HTML Document		
C++ Classes		
C# Classes		

4. **[5]** Place the following five functions into Table 2 in the order f_1, f_2, f_3, f_4, f_5 so that $f_k = \mathbf{O}(f_{k+1})$. Marking: −1 for each inversion/missing entry with a minimum of 0.

$$n^{\log_2(7)} + 2$$
$$3n + 4n \ln(n)$$
$$5\ln(n) + 6n^2$$
$$7n \lg(n) + 8$$
$$352$$

Table 2. Answer for Question 4.

5. **[4]** Let T(n) represent the number of instructions required to perform a binary search on a list of size $n = 2^k - 1$.

   If $n = 2^0 - 1 = 1$, the algorithm requires 52 instructions.

   If $n > 1$, it requires an overhead of 176 instructions (including function calls, etc.) and then proceeds to check one of the two halves.

Fill in the missing four numbers in the following recurrence relation which describes the number of operations required if the object being searched for is not found. (If the object is found, this algorithm may terminate early, but we won't worry about that.)

$$T(n) = \begin{cases} [\quad] & n = 1 \\ T([\quad]n/[\quad]) + [\quad] & n > 1 \end{cases}$$

Bonus **[2]** Answer B1 or B2 but not both (0 if you answer both).

B.1 Give the name of the command which:

   a. List the contents of a directory
   b. Is the default name of the output of g++
   c. Is the compiler you will use to tests your projects
   d. Converts your *DOS* text files *to Unix* text files.

B.2 Place a check mark under the appropriate column of Table 3 to indicate whether the program indicated runs on eceunix or on the computer you are using (the client computer) to connect to eceunix.

Table 3. Execution of programs.

	eceunix	Client Computer
Shell		
Unix OS		
Terminal		
g++		