COSC 350 Spring 2009
Quiz 1: Chapters 1, 2, and 3

Be sure to answer each question carefully and completely.

1. (1 pts) Enter your name: _____

2. (4 pts.) When developing a new algorithm, your text gives two reasons for developing the simplest algorithm first and then refining that algorithm. State briefly one of these reasons.

3. (6 pts.) In your text and in class we discussed three different ways or conventions for terminating a linked list. Briefly describe two of these giving an advantage or disadvantage for each.

4. (6 pts.) Your text lists three ways to determine the complexity of an algorithm. Give any two.

5. (18 pts.) Consider the problem of searching for an item in an array of *n* items. You might use one of three algorithms: sequential search on unsorted data, sequential search optimized for sorted data, or binary search. The item may or may not be in the array. And you may be very lucky, very unlucky, or average luck. Give the number of items you will need to examine for each of these cases:

	Item is *in* the array			Item is *not in* the array		
	Best Case	Average Case	Worst Case	Best Case	Average Case	Worst Case
Sequential Search with Unsorted Data						
Sequential Search with Sorted Data						
Binary Search						

6. (15 pts.) The table shown below under part a) depicts a linked list implemented using two arrays—and array of data and a corresponding array of links. Assume that both arrays are indexed starting at one as shown to the left of the table.

For part a)

Head: 4
Free: 6

	Data	Link
1	17	0
2	14	9
3	9	1
4	11	2
5	31	8
6	1	10
7	24	5
8	45	0
9	19	7
10	11	3

For part b)

Head:
Free:

	Data	Link
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

a) Give the contents of the list in the order they will be encountered when traversing the list.

b) In the space provided above, give the contents of the arrays and the values of *Head* and *Free* after the value 2 is inserted at the beginning of the linked list.

c) Sketch the box-pointer diagram that corresponds to the original data.

7. (8 pts.) Convert the following code from C/C++ to Python:

a)

```
#include <iostream.h>
int main(int argc, char *argv[])
{    int n, m;
     n = atoi(argv[1]);
     m = atoi(argv[2]):
     cout << m * n << endl;
}
```

b)

```
static const int N = 100;
int main()
{    int i, a[N];
     for (i = 0; i < N; i++)
     {   a[i] = i + 5;   }
}
```

8. (9 pts.) If **`foo()`** is $\Theta(n^2)$ and **`bar()`** is $\Theta(\log n)$, give the complexity for the following chucks of code:

a)
```
ans = 0
for i in range(1,n,2):
 for j in range(1,n,3):
  ans += i + j
```

b)
```
ans = 0
for i in range(n):
 j = n
 while j > 0:
  ans += i + 2 * j
  j = j / 2
```

c)
```
ans = foo() * bar()
```

8. (15 pts.) $\Theta(n^2 + 1)$ in its simplest form is $\Theta(n^2)$. Rewrite each of the following in its simplest form:

a) $\Theta(9n^3 + 2n^2 + n - 1)$

b) $\Theta(n \log n + n + \log n)$

c) $\Theta(n! + n^5 + 5^n)$

e) $\Theta((n^2+2n+1)/(n+1))$

f) $\Theta(\log_2 n + \log_{10} n)$

9. (8 pts.) Give Python code to define a *node* class that might be used to implement a *doubly linked list*.

10. (10 pts.) Give Python code for partial class definition of a *doubly linked list* similar to the one developed for homework. Use the *node* definition you gave in the preceding problem. Your definition should include member-functions to

    a) initialize a linked list when the first item is specified.
    b) locate and remove a specified node from the linked list (assuming item is on list).

Pledged: _____