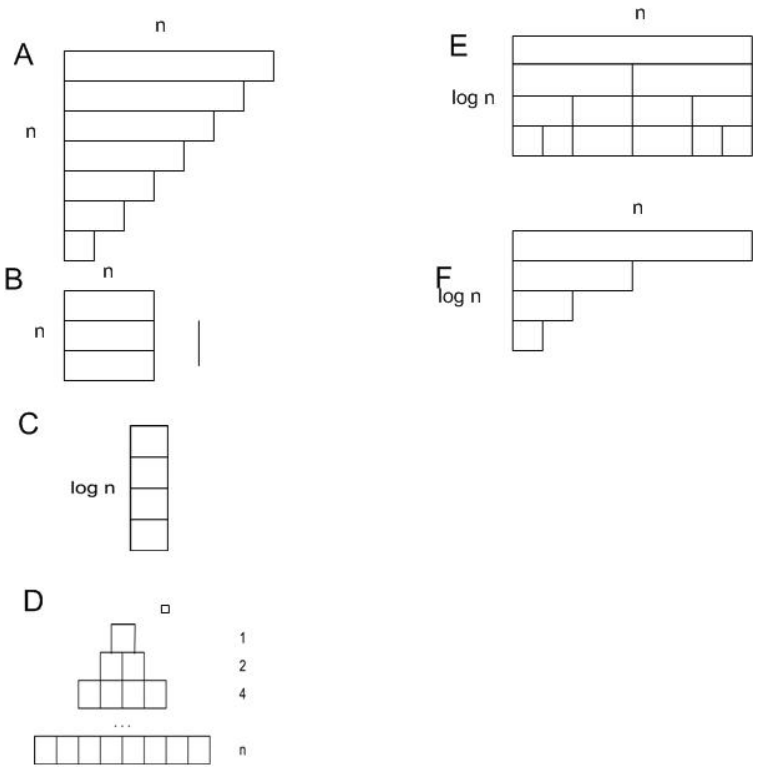
CS 2420 – Written 2
10 Points
Due September 15, 2008

Turn in your written homework in class by folding it in half lengthwise and putting your names on the outside or submit the homework through Eagle.

Note, these exercises may be done in groups of one, two, or three. If more than one person is involved, list all the names on one set of answers. Groups may change throughout the semester. Answers should not be compared with others not in your group. You will learn much more by working in a group than you will learn working by yourself.

1. The terminology *f(n)* is $O(n^2)$ is equivalent to saying *f(n)* is of order n^2 or saying *f(n)* is of complexity n^2. For each program segment (a-d) shown below:
   a. Find the complexity
   b. Select an appropriate picture from the list below (A-F) (or draw one of your own) to justify your answer.



a.
```
for (int k = 0; k<n;k++)
    for (int j = 0; j < k; j++)     // Notice j ends at k (not n)
        x = x++;
```

b.
```
void doit(int n)
{ if (n <=0) return;
  doit(n/2);
  doit(n/2);
  for (int i=0;i<n;i++)
```

```
        cout << i;
    }
```

c.
```
 void doit(int n)
 { if (n <=0) return;
   doit(n/2);
   doit(n/2);
   x++;
 }
```

d.
```
 int doit(int look,int beg, int end)
 { if (beg > end) return -1;
   mid = (beg + end)/2;
   if (A[mid] == look)
     return mid;
   if (look < A[mid])
     return doit(look, beg,mid-1);
   return doit(look, mid+1,end);
 }
```

2. Consider the following sample data. For each set of timing information, indicate the complexity of the algorithm.

a.

n	*T(n)*
2	5
4	5
8	5
16	5
32	5

b.

n	*T(n)*
2	5
4	10
8	20
16	40
32	80

c.

n	*T(n)*
2	5
4	10
8	15
16	20
32	25

d.

n	*T(n)*
2	4
4	16

8	256
16	65,536
32	4,294,967,296

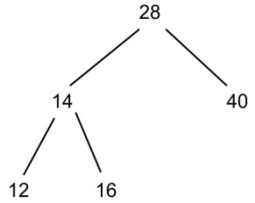
e.

n	*T(n)*
2	10
4	16
8	48
16	128
32	320

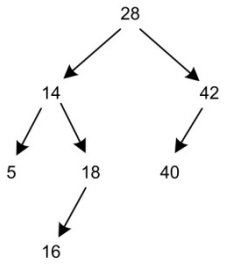
f.

n	*T(n)*
2	4
4	15
8	68
16	270
32	1024

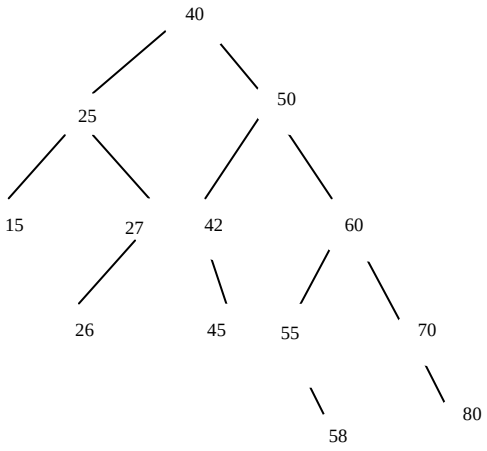
3. For the AVL tree below, which of the following are correct? Which are incorrect?
    a. If a key with value 42, 29, or 27 is inserted in the tree, it does not lose the AVL property.
    b. After the insertion of 20, a single rotation is necessary to restore the AVL property of the tree.
    c. A double rotation is necessary to restore the AVL property after the insertion of 20. This makes 16 the new root of the tree.
    d. A single rotation is needed to restore the AVL property if any node with value less than 14 is added to the present tree.



4. An AVL tree of height 4 must have at least _____ nodes
    e. 21
    f. 7
    g. 14
    h. 12
    i. None of the above.
5. Consider the following AVL tree. Show the tree after insertion of 17 followed by deletion of 28.



6. Show the results of inserting items 1 through 8 in order in an initially empty AVL tree.
7. In the following AVL tree, show the tree after deletion of 15.



8. Show an AVL tree for which an addition will cause multiple rotations. We count a double rotation as one rotation not two (it's just fancier).