

## COP 3502 (Computer Science I) Final Exam 12/6/2013

**Last Name:** \_\_\_\_\_, **First Name:** \_\_\_\_\_

1) (10 pts) What are the values of the following expressions in C? Please show your work to get full credit and put a box around your final answer.

a)  $47 \ \& \ 131$

b)  $97 \ | \ 122$

c)  $63 \ ^ \ 99$

d)  $13 \ \ll \ 3$

e)  $173 \ \gg \ 4$

2) (10 pts) Complete the function below so that it returns a pointer to the node in the linked list that points to the smallest item in the list. For example, if the list stores 3, 12, 18, 2, 9, and 6, with front point to the 3, a pointer to the node storing the two should be returned. Please use the struct and function prototype shown below. Return NULL if the input list is NULL.

```
struct node {
    int data;
    struct node* next;
};
```

```
struct node* getPtrToMin(struct node* front) {
```

```
}
```



5) (10 pts) Solve the following recurrence relation using the iteration technique. Express your final answer as a closed form solution in terms of  $n$ , without any Big-Oh notation.

$$T(n) = 3T(n - 1) + 1, T(0) = 0$$

6) (10 pts) The following question deals with dynamic memory allocation involving the following struct:

```
typedef struct {
    char title[50];
    char author[50];
    int pages;
} BookT;
```

a) (2 pts) Allocate an array of  $n$  items of type `BookT*`. Call the array `myBooks`. Assume  $n$  is already declared and stores a positive integer.

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b) (4 pts) Consider the situation where `myBooks[i]` is a pointer to an array of one genre of book. Assume that the integer array `numBooks` of size  $n$  is such that `numBooks[i]` stores how many books of genre  $i$  there are. For example, if  $n = 4$  and `numBooks` stored 3, 12, 4 and 7, then there are 3 books of genre 0, 12 books of genre 1, 4 books of genre 2 and 7 books of genre 3. Write code to allocate space for each of  $n$  arrays to store each genre of books. Declare any variables you need but assume that `numBooks` exists and stores the desired values already.

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c) (4 pts) Free all of the memory that is directly or indirectly pointed to by `myBooks` after step b.

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7) (10 pts) Consider testing a program that adds two large integers (upto 10000 digits each). Each operand is allowed to be any non-negative integer with 10000 or fewer digits, all integers must not have leading zeros and zero is expressed with the single digit 0. Give ten different categories of **valid** test cases for this program. For small cases, list an explicit example that fits in that category. For larger cases, describe an example test case (ie. 9000 1s followed by 1000s 5s). For each category, describe specifically the properties of the two operands, which you may refer to as A and B, where A is the first operand and B is the second operand.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

8) (10 pts) Complete the following program so that it prints out all lists of sorted positive integers that add up to 15. (Note: There are 176 total solutions!)

```
#include <stdio.h>

void solve(int values[], int k, int sum);

int main() {
    int values[15];
    solve(values, 0, 15);
    return 0;
}

void solve(int values[], int k, int sum) {

    int i;

    if ( _____ ) {
        for (i=0; i<k; i++)
            printf("%d ", values[i]);
        printf("\n");
    }

    int start = 1;
    if (k > 0 && values[k-1] > start) start = values[k-1];

    _____ {

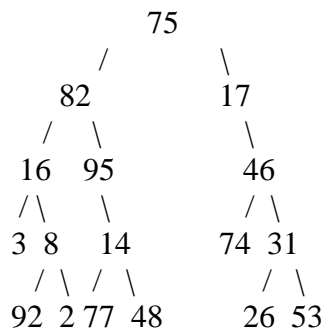
        _____

        _____

    }
}
```

9) (10 pts) Determine  $\sum_{i=n}^{2n-1}(in + n + i + 3)$  in terms of n. Put a box around your final answer.

10) (9 pts) Provide the preorder, inorder and postorder traversals of the binary tree shown below.



Preorder: \_\_\_\_\_

Inorder: \_\_\_\_\_

Postorder: \_\_\_\_\_

11) (1 pt) What's the last name of the man who started the department store Kohl's? \_\_\_\_\_

**Scratch Page – Please clearly mark the work on this page you would like graded.**