CMSC 15200 Midterm 2B

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TOTAL POINTS

79.5 / 100

QUESTION 1

1 Short Answer 1a 4.5 / 5

- **- 0 pts** Correct
- ✓ **- 0.5 pts Minor mathematical error or using wrong number of bytes for enum**
- **- 1 pts** Missing item
- **- 3 pts** Counting space for both ucstudent and ucemployee
- **- 5 pts** No answer

QUESTION 2

2 Short Answer 1b 8 / 12

- **- 0 pts** Correct
- **- 1 pts** First line is using ->
- **- 2 pts** First line is not assigning the enum correctly
- **- 1 pts** First line is not accessing correct struct member
- **- 4 pts** First line is not setting the title/completely incorrect
- **- 1 pts** Second line is using ->
- ✓ **- 1 pts Second line is not accessing correct struct member**
- **- 4 pts** Second line is not copying the string/completely incorrect
- **- 1 pts** Third line is using ->
- **- 2 pts** Third line is not assigning enum correctly
- ✓ **- 1 pts Third line is not accessing correct struct member**
- **- 4 pts** Third line is not setting division/completely incorrect
- **- 1 pts** Incorrect string usage/declaration/copy function
- ✓ **- 2 pts Using quotes around enums**
- **- 12 pts** No answer
- **- 1 pts** Must not use casting
- **- 2 pts** Using ucmember instead of men

QUESTION 3

3 Short Answer 1c 5 / 10

- **- 0 pts** Correct
- **- 2 pts** Extra 'Hi' in second string2
- **- 2 pts** Missing 'Hi' in string1
- **- 1 pts** No quotation marks
- ✓ **- 5 pts string2 completely incorrect**
- **- 2 pts** Did not draw '\0' character(s) or '\0' in incorrect spot
- **- 2 pts** More than two lines
- **- 1 pts** Did not draw/indicate spaces between Howdy and Hi in string1
- **- 2 pts** Missing Howdy in string2

QUESTION 4

4 Short Answer 1d 13 / 13

- ✓ **- 0 pts Correct**
- **- 3 pts** Both v1 and v2 have not been cast correctly to ucemployee
- **- 1.5 pts** One casting issue
- **- 3 pts** Incorrect comparisons: incorrect struct members or pointer notation or does not compare name
- **- 1 pts** Returning only two correct values
- **- 1 pts** Minor casting syntax issue
- **- 2 pts** Does not use -> (but has pointers)
- **- 2 pts** Uses incorrect struct members
- **- 1 pts** Compares other properties of employee
- **- 3 pts** Does not return 1, -1, 0
- **- 3 pts** Wrong string comparison function/approach
- **- 6 pts** Only casting has been performed, incomplete
- **- 1 pts** Wrong string comparisons, but a more correct alternative present

- **1 pts** Missing return with strcmp

  By including string.h you can't redeclare strcmp, but I will assume you didn't intend to use your version.

QUESTION 5

5 Linked List 2 **30 / 30**

✓ **- 0 pts** **Correct**

- **2 pts** Checking for NULL list
- **5 pts** Separate case handling head
- **3 pts** head case (partial)
- **10 pts** advancing to the proper place
- **2 pts** advancing to the proper place (partial) (wrong index)
- **5 pts** Proper inserting the node
- **2 pts** proper inserting the node (partial)
- **3 pts** Handling pointers in node list
- **3 pts** Returning 0 in case of short list
- **3 pts** malloc the new node
- **2 pts** return correct value
- **2 pts** major syntax errors

QUESTION 6

6 Tree 3 **19 / 30**

- **0 pts** Correct
- **1 pts** Incorrect variable name
- **1 pts** Incorrect function name
- **5 pts** Should only recursively call left child if root->item > low
- **2 pts** More than one call to comp per function (inefficient)
- **5 pts** Incorrect comparison call

✓ **- 5 pts** **Missing call to right subtree**

✓ **- 5 pts** **call to print in incorrect case**

- **3 pts** Should recursively call right subtree if root <= low
- **5 pts** Need to recursively check left subtree if root->item > low
- **3 pts** Function call without parameters
- **5 pts** Missing recursive call when low == root
- **2 pts** Calls comp before checking if node is null
- **3 pts** No base case check
- **1 pts** Missing return in base case
- **5 pts** Prints when condition is not met
- **5 pts** Incorrect iteration over left subtree
- **2 pts** Multiple incorrect variable names and/or function calls
- **2 pts** Not passing print function to helper function
- **3 pts** Using "." instead of "->" to access elements of pointer to struct
- **2 pts** Directly comparing root->item to low without using comp
- **5 pts** Never calls print
- **5 pts** Does not check or store value of comparison function call
- **5 pts** Missing case where root > low
- **1 pts** comp should be called with node->item

✓ **- 1 pts** **print should be called with node->item**

- **2 pts** Doesn't use passed print function
- **2 pts** Base case checks root->item instead of root

name: Lucius Guo

lab time: 5:00 pm

CS 152
Exam 2
Winter 2020
11:30am class

Short Answer	/40
Linked List Imp	/30
Tree Implementation	/ 30
Total	/100

1. No one may leave for any reason and come back to work on his/her test.
   If you need to go to the restroom, go now.

2. You may have 1 sheet of notes, hand-written, double-sided

3. Your backpack must be zipped up.

4. You may not use any electronic devices of any kind. Make sure your cell phone is turned off so it does not ring during the test.

5. You may not wear hats, hoods, sunglasses, nor do anything else that would obscure your eyes.

6. You may not sit near your partner if you are partnered in programming or lab (within 3 seats in any direction)

8. We will not answer questions during the exam.

9. Do not hold your test up. It must stay on your desk.

10. If you seem to be looking around, you will be moved to the front to allow you to look around without having other students' test in your field of vision.

1. Short Answer: (you may use string library functions)

```
enum position_tag { UC_EMPLOYEE, UC_STUDENT };
enum division_tag { UC_PSD, UC_BSD, UC_SSD, UC_HD, UC_PME };
typedef unsigned int uint;
```

```
typedef struct {
        char name[50]; 50
        uint year_hired; 8
        enum division_tag division; 5
        uint salary; 8          101
        char title[30]; 30
} ucemployee;
```

```
typedef struct {
enum division_tag division; 5
char name[50]; 50
uint year_entered; 8
char major[50]; 50
uint UCID; 8          121
} ucstudent;
```

```
union _ucnode {
        ucemployee emp;
        ucstudent stu;
} ;
typedef struct {
        enum position_tag position; 2
        union _ucnode data;
} ucmember;
```

a. (5) If a char and enumerated type are 1 byte each, and a uint is 8 bytes, how much space is allocated for a single ucmember struct? Show your work.

The ucmember struct has an enum which is 2bytes big. We always store enough space for the bigger union which is ucstudent (5+50+8+50+8 =121). So a single ucmember struct will be alloated 121+2 = $\boxed{\text{123 bytes}}$

b. (12) Given the declaration below, write three lines of code.
1) set the tag of mem so that it is designated as an employee, not a student
2) copy the string "Associate Professor" into the title
3) set the division to be UC_PSD

`ucmember mem;`

```
mem.position = UC_EMPLOYEE;
mem.data.title= "Associate Professor";
mem.data.division = UC_PSD;
```

Howdy

c. (10) Draw the end state of string1 and string2 after the following commands:

```
char string1[50], string2[50];
strcpy(string1, "Howdy");
strcpy(string1+20, "Hi");
strcpy(string2, "Whoop");
strcat(string2, string1);
```

Final state

string 1: 'H' 'o' 'w' 'd' 'y' ... 'H' 'i' '\0' (20 spaces in the array)

string 2: Same as String 1;

d. (13) Write a generic compare function that compares two ucemployee structs by name.

```
int compare_ucemployee(void *v1, void *v2)
{
  ucemployee *e1 = (ucemployee *)v1;
  ucemployee *e2= (ucemployee *)v2;
int result = strcmp(e1->name, e2->name);
 if(result == 0)
    return 0;
 if(result < 0)
    return -1;
 else
    return 1;

}
#include <string.h>
```

```
int strcmp(const char *x, const char *y)
{
 while(*x)
 {
  if(*x != *y)
    break
  x++;
  y++;
 }
 return *(const unsigned char *) x -
        *(const unsigned char *)y;
}
```

2. Linked List Implementation

(30) Write a function that inserts the val at the index specified, where the head is index 0. Do not remove or replace anything in the list – instead, place val in between the current index-1 and index node. If the list has fewer the index-1 items, do not insert into the list. Return 1 if the insertion was successful and 0 if the list was too short. Use the following list definitions:

```
typedef struct _node node;
struct _node {
    void *item;
    node *next;
};
```

```
typedef struct _llist {
    node *head;
    node *tail;
} llist;
```

```
node * newNode (void* vcl)
{
  node *nPtr;
  nPtr = (node *) mlloc(sizeof(node));
  nPtr-> item= vcl;
  nPtr-> next = NULL;
  return nPtr;
}
```

```
int insert ( llist *lst, void *val, int index )
{ //when list is empty
  if (lst!=NULL && index ==0)
  { node *new = new Node (vcl);
    new ->next = lst->head;
    lst->head= new;
  }                              return1;
  node *holder = lst -> head;
  int i;
  for(i=0 ; i < index ; i++)
  {
   holder = holder ->next;
  }

  node *holder 2 = lst->head;
  for(i=0 ; i <= index ; i++);
  {
    holder2 = holder 2->next
  }
  node *new = new Node (vcl);
  holder ->next = new;
  new -> next = holder 2;
  return 1;



}
```

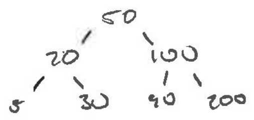
```
int length =0;
inode *holder 1 = lst -> head;
while (holder 1 != lst -> tail)
{    length ++
     holder = holder -> next;
}
if (length < index -1)
   return 0;
```

3. Tree Implementation

(30) Write an ***efficient*** function (fewest calls to comp) that prints out all **items in a BST** that are ***greater than*** the second parameter. comp returns -1 for less than, 0 for equal, 1 for greater than. You may continue your code onto the next page. Assume the following definitions:

```
typedef struct _bnode bnode;
struct _bnode {
    void  *item;
    bnode *lsub;
    bnode *rsub;
};
```

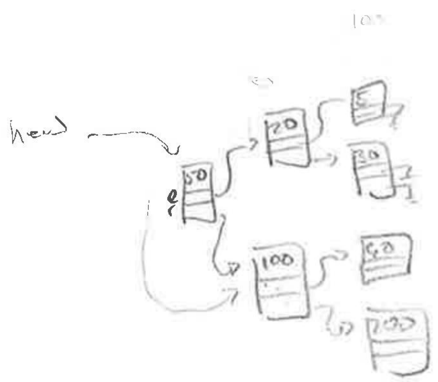
```
typedef struct {
    int (*compare)(void*, void*);
    void (*print_item)(void *);
    bnode *root;
} bst;
```



```
void bst_print_greater_than ( bst *tree,  void *low)
{   // if no tree, do nothing
    if (tree == NULL)
            return;
    else
            item_print(tree->root, low, tree->compare, tree->print_item);
}
                                    50
void item_print ( bnode *root,  void *low, int (*comp)(void *, void *), void (*print)(void *) )
{
   if(root==NULL)
      return;
   if(comp (low, root-> item >= 0)
   {
      item_print ( root->right, low, comp, print);

      print(root);;
   } exit;
   else
   {
      item_print (root -> left, low, comp, print);
   }
 }
```

item print (root , 100, comp, print)


head
50
20
5
30
100
90
200