TCB2
152

THE UNIVERSITY OF THE WEST INDIES
ST. AUGUSTINE

EXAMINATIONS OF APRIL/MAY 2019

Code and Name of Course: COMP1603 — Computer Programming III Paper:

Date and Time: Tuesday 14th May 2019 1 pm Duration: 2 Hours

INSTRUCTIONS TO CANDIDATES: This paper has 5 pages and 3 questions

Answer all questions
All Questions are not Equally Weighted

1. (a) Consider the program shown below. Assume that it compiles successfully. Give the output of the program.

```
#include <cstdlib>
#include <iostream>
using namespace std;

int main() {

    int x, y;
    int *px, *py, *z;
    px = &x;
    py = &y;
    x = 30;
    y = 70;
    z = &x;
    *z = y - *z;
    cout <<  " 1. *z is " << *z << endl;
    *py = *py + 10;
    cout <<  " 2. The value of *py is " <<  *py << endl;
    int arr[] = {12,14,16,18};
    int *ptr = arr;
    for (int j=1; j <= 3; j++) {
      (*ptr) *= 2;
      ptr++;
    }
    cout << "3." << endl;
    for (int j=0; j < 4; j++)
      cout << arr[j] << '\t';
    system("PAUSE");

}
```

[5]

(b) Describe an application where stacks are used. [2]

[Question 1 continues on the next page]

(c) Assume that a Queue, **q**, contains 50 integers. **q** is implemented using linked lists.

Write code to dequeue the values from **q** one at a time and place each value dequeued from **q** into a stack, **s**.

Finally, pop the elements of the stack **s** (one at a time) and find the sum of the values popped that end with the digit "2". Example: If some of the values popped were 10, 20, 22, 102, 155, 362, then only 22, 102, 362 would be summed. Print the sum. **(Note that the sum must be stored in a pointer variable.)**

You may assume the existence of the usual Stack and Queue functions. Some prototypes are listed below.

```
Stack * initStack();
bool isEmpty (Stack * s);
bool isFull (Stack * s );
int peek (Stack * s);
void push (Stack * s, int n);
int pop (Stack * s);

Queue * initQueue ();
bool isEmpty (Queue * q);
int peek (Queue * q);
void enqueue (Queue * q, int n);
int dequeue (Queue * q);
```

[8]

Total marks 15

2. (a) What output is produced by the call **fun(1,6)** of the following recursive function? [7]

```
void fun(int m, int n){
  if (n >= 0) {
    fun(m + 2, n - 2);
    cout << n << " ";
    fun(m + 1, n - 3);
  }
}
```

[Question 2 continues on the next page]

(b) Write a **recursive** function to return the contents of the last node of a linked list. If the list is empty, return -999. The function prototype is

int recLast (Node *top);

Node declaration:

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

[5]

(c) Write a **recursive** function to read a line of data terminated by **$**, character by character, and print it with the characters reversed.
E.g. given abcd$, the function prints dcba

Note: No array or linked list storage must be used. [5]

(d) This part is based on a linked list of integers.
The declarations for the nodes of the linked list follow:

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

Write a function **deleteNode** which accepts a pointer **top**, to an unsorted linked list of integers and an integer **key**. The function deletes the node containing **key** from the linked list. Return a pointer to the changed list. The prototype for the function is

Node *deleteNode (Node *top, int key)

Note that the linked list may be empty initially and it is possible that **key** is not in the list. Print an appropriate message if **key** is not found in the list. [8]

Total marks 25

[Please turn the page]

3. Two words are anagrams if one word can be formed by rearranging all the letters of the other word, for example: sister, resist. A word is represented as a linked list with one letter per node of the list.

Write a function which, given **str1** and **str2** each pointing to a word of lowercase letters, returns **true** if the words are anagrams and **false** if they are not. Your algorithm **must** be based on the following: for each letter in **str1**, search **str2** for it; if found, delete it and continue; otherwise, return **false**.

Ensure that you show the declarations for the linked list to be used for storing the strings.

[10]

Total Marks 10

End of Question Paper
(Total Marks 50)