International Institute of Information Technology, Hyderabad
ICS101:M-17:Computer Programming
Final Exam: Set A

Max. Points: 150

[Time: 180 Mins]

Part I: *Give brief and precise answers to the following.* [5 × 10 = 50]

1. Explain the difference between the results of the expression `x+1` when `x` is an integer and when `x` is a pointer.
2. Explain the difference between a function declaration and function definition. What are the effects of compiling two files together where the same function is both declared and defined in both files? Can pre-processor directives (ifndef) help in this case?
3. Explain the steps that are taken when a `realloc()` call is made on a pointer that points to a block of already allocated memory.
4. Write a function to swap two elements of a linked list, given pointers to them. Write down your assumptions.
5. Explain the roles of pre-processor, compiler and linker during the compilation of a C program.

Part II: *Write functions to solve the following problems with comments where required.* **You should write your logic in sentences before writing the function itself** [5 × 20 = 100]

1. Assume that you have an **array** of student records, where each student record also has a pointer variable that can store the location of the next record in a list. Write a function that takes the array of records and the number of records as input and assigns values to the pointers so that the linked list of arrays are in sorted order of marks. Return value is a pointer to the first element in the sorted list. Note that the actual records should not be moved.
   ```
   Student *sortList(Student stu[], int numStudents);
   ```
2. Write a function that takes as input a character array containing and arithmetic expression and the index of a bracket, find it matching bracket.
   ```
   int findPairBracket(char expr[], int length, int pos)
   ```
3. Write a program that takes an integer of two digits or less as a command line argument and prints it in words. For *e.g.*, 15 should be printed as *fifteen*, 37 as *thirty seven* and 8 as *eight*. If the command line argument is incorrect, you should print a helpful message.
4. You are given an array of integers and a number (called a pivot). Write a function that divides the array into two parts: The first part has numbers lesser than or equal to the pivot, followed by the second part where the numbers are larger than the pivot. The two parts need not be sorted. Return the index of separation.
5. Given an array of integers (may contain positive and negative values), write a function that finds the sub-array (continuous sequence of number in the array) that sums to the smallest number.