SCHOOL OF SCIENCE & MEDICINE

Exam Title: **PROBLEM SOLVING AND PROGRAMMING 2**

SPRING 2015

EXAMINATION FOR THE DEGREE PROGRAMMES IN

BSC Computing September 2014 and January 2015

Exam Code: 20152AIAP104AWP

TIME ALLOWED: **2 HOURS**

MATERIALS PERMITTED: None

MATERIALS PROVIDED: Word sheet will be provided electronically in the exam folder

INSTRUCTIONS:

1. Answer ALL THREE questions (Question 3, you need to answer either A or B).
2. This examination requires both written work in the answer book as well as practical work on the computer.
3. Be tidy with your written work. Marks may be deducted for untidy work.
4. You must save your practical work on the designated disk drive on the desktop of your computer.
5. You must organize your answers into folders, one folder for each question. Do not provide more than one answer to each question.
6. You may use the file "ExamReferencePSP2" on the P drive for a quick reference of some aspects you might need to solve the questions.

Question 1 (practical) (25 marks)

Define a car structure that contain the following fields:

- Car Number
- Car model name
- Year of manufacture
- Colour

1. Create a variable for the structure above, populate suitable data in this variable and display the data to the output.
2. Create an array of ten cars, then insert four cars into the array and display the data to the output.

Question 2 (practical) (20 marks)

Write a C program that can populate the given integers below in a linked list called MainList:

{6, 3, 60, 8, 4, 2, 30, 42, 55, 14, 24, 56, 12, 67, 112};

Create another two linked lists, the first is called Below50, and the second called Above50. Write a function that receives the three lists: MainList, Below50, and Above50. The function will split the values from the MainList depending on the values, the values that are below 50 will be inserted in the Below50 list, and the values that are above 50 will be inserted in the Above50 list.

Print the values of the two generated lists, below50 and above50.

Question 3 (written) (20 marks)

Answer either A or B.

A: Binary tree

Using the binary tree in Figure 1 below, answer the following:

1. Is this tree is a balanced tree? Explain why?
2. Explain the needed steps to delete node 35.
3. Explain the necessary steps to update the node value 25 to 100.
4. Write a C function that can traverse all the nodes of the tree below and print out their values.
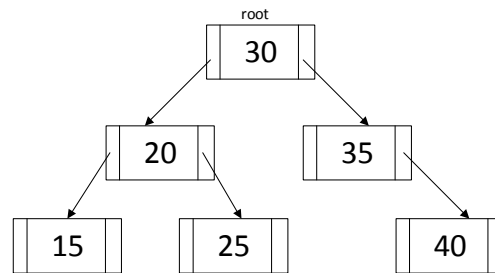5. Write a C function that can be used to insert a new node to the tree.

Figure 1

B: Hashing

Hashing is one of the important searching method that used in some systems. You are asked to design a hashing system for the Applied Computing department to save and retrieve the student information. The department has relatively small number of students but yet it is growing fast. The number of student in department now is around 70.

1. Design a hashing table that can accommodate the future growth of the department.
2. Design a hashing function that can use the student ID as a key.
3. Design a rehashing function that can be used to produce a minimum clashes as possible,
4. Justify your answers by giving a suitable example.

Question 4 (practical + written) (35 marks)

Organising and scheduling printing jobs are very essential operation developed in most of the operating systems. Design a dynamic structure that allows the system to accept unlimited number of users and allocate a list of unlimited number of printing jobs. This kind of system can be presented in the figure 2 below.
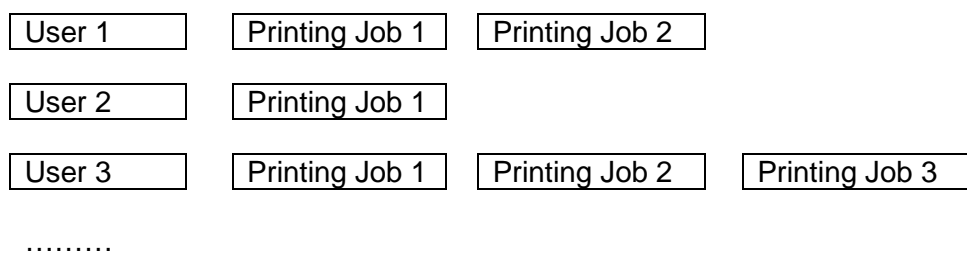

Figure 2

1. Create a suitable structure that can present the above printing system.
2. Insert at least two users with at most two printing jobs for each.
3. Print the related data for each user.

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