THE UNIVERSITY OF BUCKINGHAM

SCHOOL OF SCIENCE

Exam Title : **PROBLEM SOLVING AND PROGRAMMING 1**

Spring 2016

EXAMINATION FOR THE DEGREE PROGRAMMES IN

Computing, October 2015 entry and January 2016 Entry

Exam Code:	20162AIAP113AWP
TIME ALLOWED:	**2 HOURS**
MATERIALS PERMITTED:	None
MATERIALS PROVIDED:	ExamReferencePSP on P drive

INSTRUCTIONS:

1. Answer ALL THREE questions.
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 “ExamReferencePSP” on the P drive for a quick reference of C language.

Question 1 (40 Marks)

This question is concerned with developing and implementing a solution for managing employee attendance of work in a company. It is assumed that the company has a swipe card system that records the time that the employee arrives at work and the time that the employee leaves the work place on each week day. In this question, we use the keyboard to enter the time simulating the reading of the swipe card system.

Develop your program through the following steps:

(i) The first problem to solve is to calculate the amount of time elapsed in terms of the number of hours and minutes between the time of arrival and the time of leaving of an employee for one week day. You need to assume that the arrival time and the leaving time are respectively represented as a 4-digit integer. For instance, if the arrival time is recorded as 0945 and the leaving time as 1815, the amount of elapsed time is 8 hours and 30 minutes. **In the answer book**, describe your solution for solving this problem in either a pseudo code or flowchart.

(10 marks)

(ii) Implement your solution for (i) **by writing a program in C**. Test your program to evaluate the solution.

(15 marks)

(iii) **Modify your program for (ii)** such that the task in (i) is repeated for every week day of the week from Monday to Friday. In addition, the solution also counts how many full working days the employee has for the week. A full working day means that the time elapsed between the time of arrival and the time of leaving must be greater or equal to 8 hours.

(15 marks)

Question 2 (20 Marks)

Write a program that contains a *function* to calculate the value of the following expression:

$$1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \cdots + \frac{1}{N}$$

where N is a positive integer. The main program should test the working of the function.

NB:

1. Please note that recursive function receives more credit.
2. You can use your answer book as rough paper, remember that only your program will be marked.

Question 3 (40 Marks)

This question is about developing and using a library of remote functions. **This question requires you to write your solutions in pseudo code in the answer book**, **construct the program components in C**, and then test if the whole program works.

(i) A prime number is a positive integer that is greater than 1 and has no divisors other than the number itself and 1. Develop a function that determines if a given positive integer is a prime number or not.

(15 marks)

(ii) The greatest common divisor (GCD) of two given integers is the largest positive integer that can divide the two given integers. For instance, the GCD for 3 and 12 is 3, and the GCD for 6 and 8 is 2. Develop a function that returns the GCD of any given two integers.

(20marks)

(iii) Organise the two functions in (i) and (ii) as remote library functions. Test the working of the functions by calling them from the main program.

(5 marks)

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