

SCHOOL OF SCIENCE & MEDICINE

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

SPRING 2015

EXAMINATION FOR THE DEGREE PROGRAMMES IN

September 2014/January 2015 Entry

Exam Code: 20152AIAP103AWP

TIME ALLOWED: **2 HOURS**

MATERIALS PERMITTED: None

MATERIALS PROVIDED: ExamReferencePSP on P drive

INSTRUCTIONS:

1. Answer ALL 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 (35 Marks)

This question is concerned with estimating journey time for travelling from one city to another on a motor vehicle. For this question, use your answer book as rough paper. Only your program will be marked.

- (i) Write a program that reads the distance between the two cities (kilometres) and the travelling speed of the motor vehicle (kilometres per hour). The program then calculates and displays the amount of time (hours) needed for the journey.
(10 marks)
- (ii) The normal cruise speed of the motor vehicle on a motorway (M road) is about 120 kilometres per hour. The cruise speed of the vehicle on a main road (A road) is about 90 kilometres per hour, whereas the speed on an urban road (U road) is about 45 kilometres per hour. Modify the program in (i) such that the program not only reads the total distance of the journey, but also how much of the journey (in kilometres) are on M, A, and U roads respectively. The program then calculates and displays the amount of total travelling time for the journey.
(15 marks)
- (iii) Modify the program for (ii) further so that it repeats the process of estimating travelling time upon the user's request.
(10 marks)

Question 2 (25 Marks)

Read through the program listed below carefully. The program contains errors.

- (i) Correctly identify the errors, describe them and explain their causes in the answer book. Be aware that identifying errors incorrectly will result in reduction of your marks.
(15 marks)
- (ii) Make minimal amount of changes to the program to correct these errors. Save the corrected program into the designated folder for this question.
(10 marks)

```
#include "stdafx.h"
#include <iostream>
using namespace std;

void f(int&, int);

int main()
{
    int N, s;

    cout << "how many? ";
    cin >> N;
    f(N, s);
    cout << "The result = " << (double) s / N << endl;

    return 0;
}

void f(int &n, int s)
{
    int m;
    cout << "enter " << n << " integers:- " << endl;
    for (; n > 0; n--) {
        cin >> m;
        s = s + m;
    }
}
```

Question 3 (40 Marks)

The value of π is used in calculations for many different application purposes. On computers, the value of π is estimated using a numeric solution. The following expression defines a way how π is estimated:

$$\pi = 4 \times (1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} \dots)$$

There is hence a need to define a function for estimating the value of π . Since different applications may require the value to be precise to a certain level (normally indicated by *the number of significant digits*), the function must consider this requirement when it is defined. For instance, 3.1415 has 5 significant digits whereas 3.14 has only 3 significant digits, and the former is considered more precise than the latter.

- (i) Develop a solution for estimating the value of π given a level of precision in terms of the number of significant digits. Describe your solution in either a pseudo code or a flowchart in your answer book.
(15 marks)
- (ii) Implement the function in C.
(20 marks)
- (iii) Make the function becomes a remote library function. Test it with different numbers of significant digits.
(5 marks)

END OF PAPER