Indian Institute of Technology Kharagpur

AUTUMN Semester, 2015
COMPUTER SCIENCE AND ENGINEERING

CS19001: Programming and Data Structure Laboratory

Assignment – 4

Full Marks: 10

Time allowed: 3 hours

INSTRUCTIONS: Please see the questions and write C programs step by step. Ensure proper indentations to improve the readability of your code. All these features are necessary and absence will lead to deduction of marks.
Please do not forget to upload files to *Moodle* before you leave.

Functions in C

1. Write a complete C Program to multiply two non-negative integers, using a function `unsigned int multiply (unsigned int a, unsigned int b)`, using the "shift-and-add" scheme introduced in class. Your program should display the product, as returned by the `multiply()` function. (4 marks)

2. Write a complete C program to find whether a positive integer is a power of two, using a function `void is_power_of_two (unsigned int number)`. The number would be input by the user. Use the shift operator, and iterate over each bit. DO NOT COMPARE WITH SUCCESSIVE POWERS OF TWO. Print a proper message from inside the function `is_power_of_two()` to tell the result of your computation. (4 marks)

3. Write a complete C program to find and print the approximate numerical value of the mathematical constant π, using the following expression: $\frac{2}{\pi} = \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{2+\sqrt{2}}}{2} \cdot \frac{\sqrt{2+\sqrt{2+\sqrt{2}}}}{2} \ldots$
Your C program should have a function `double calculate_pi (unsigned int k)` to calculate and return the value. The value calculated should be such that its numerical difference with the value returned by a function call `acos(-1.0)` should be less than 10^{-k}. The positive integer value k to determine the precision of the calculated value would be taken from the user. Your program should display the value returned by the `calculate_pi()` function. You may use the standard library functions `acos()`, `sqrt()` and `pow()`, which will require you to include the `math.h` header file, and compile using the `-lm` flag. (4 marks)
