INTRODUCTION TO SCIENTIFIC AND ENGINEERING COMPUTATION
2017-2018 SPRING MIDTERM 1

105 minutes Mar 13, 2018

Id	Full Name	Signature	Q1	Q2	Q3	Q4	Q5	Q6	Total
			/ 13	/ 25	/ 15	/ 15	/ 12	/ 20	/ 100

No questions are allowed. Answer the questions to the best of your understanding. If you need to make extra assumptions, state them clearly. Make sure that all your answers are sufficiently explained. Suggested order for answering the questions: 5-1-3-4-2-6 (order of topics as covered in class).

1. Simplify the following expressions/statements. Here, `b` is a variable of type `bool` and `n` is a variable of type `int`. Briefly explain your answers.

   (a)

   ```
   b == true
   ```

   (b)

   ```
   b != true
   ```

   (c)

   ```
   if (n == 0) {
       b = true;
   } else {
       b = false;
   }
   ```

   (d)

   ```
   b = false;
   if (n > 1) {
       if (n < 2) {
           b = true;
       }
   }
   ```

   (e)

   ```
   if (n < 1) {
       b = true;
   } else {
       b = n > 2;
   }
   ```

   ---

2. Consider the following function:

```
int mystery(int n)
{
    int x = n;
    while (x > 9) {
        x = x / 10;
    }
    return x;
}
```

(a) What does this function calculate? Explain by giving an example. (*Note*: Assume that `n` is positive.)

(b) Write a function that will return the number of digits in a positive integer. Don't use math functions like `pow` or `log10`. Explain how it works by giving an example.

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3. The following pseudocode describes how a bookstore computes the price of an order from the total price and the number of the books that were ordered.

   Read the total book price and the number of books.
   Compute the tax (7.5% of the total book price).
   Compute the shipping charge ($2 per book).
   The price of the order is the sum of the total book price, the tax, and the shipping charge.
   Print the price of the order.

   Translate this pseudocode into a C program.

4. Rewrite the following do/while loop into a while loop. Explain your answer.

```
int n;
scanf("%d", &n);
double x = 0;
double s;
do {
    s = 1.0 / (1 + n * n);
    n++;
    x = x + s;
} while (s > 0.01);
```

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5. Find at least three problems in the following program for calculating the average of two numbers provided by the user. Explain your answer.

```
#include <stdio.h>

int main()
{
    int total;
    int x1;
    printf("Please enter a number: ");
    scanf("%d", &x1);
    total = total + x1;
    printf("Please enter another number: ");
    int x2;
    scanf("%d", &x2);
    total = total + x1;
    double average = total / 2;
    printf("The average of the two numbers is %f\n", average);
    return 0;
}
```

6. The value of $ln(1+x)$ can be calculated using the formula given below. Write a C function that takes a real number x and an integer n as its arguments and returns the value of $ln(1+x)$ where n determines the number of terms in the summation. Don't use the `pow` function.

$$ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$$