Computer Science 2530  
Section 001  
Fall 2019  
Exam 1

You have 50 minutes. You may use one prepared 8.5 × 11 sheet of paper. All questions concern the C++ programming language. For the multiple choice questions, marked [MC], circle the letter of the best answer, even if no answer is ideal. For the other questions, write the answer after the question in a clear and readable way. Check your answers.

1. [MC] What is the value of C++ expression $9 - 3 - 3 \times 3$?
   (a) $-3$
   (b) 0
   (c) 1
   (d) 9
   (e) 15

2. [MC] What is the value of C++ expression $19/4 + 3/4$?
   (a) 7
   (b) 5.5
   (c) 5
   (d) 4.5
   (e) 4

3. [MC] What is the value of C++ expression $(16 \mod 3 + 1)$?
   (a) 1
   (b) 2
   (c) 2.33333... 
   (d) 6
   (e) 6.33333... 

4. [MC] What is the type of expression $3.0*5.0$?
   (a) int
   (b) long
   (c) double
   (d) real
   (e) bool
5. [MC] When you create a variable \( x \) using statement

\[
\texttt{double x;}
\]

(a) \( x \) has no initial value, and using \( x \) before you initialize \( x \) will lead to a run-time error.

(b) \( x \) has an initial value of 0.

(c) \( x \) will have an initial value, but you have no way of knowing what that value will be when the program runs.

(d) \( x \) has no initial value, and using \( x \) before you initialize \( x \) will lead to a compile error.

6. What is the value of variable \( x \) after the following statements?

\[
\texttt{int y = 45;}
\texttt{int x = y;}
\texttt{y = 10;}
\texttt{x++;}
\texttt{y++;}
\]

Answer: ____________________________

7. Function \( f(n) \) is defined below in C++. What is the value of C++ expression \( f(f(3)) \)?

\[
\texttt{int f(const int n)}
\texttt{}{
\texttt{    int m = (n+1)*(n+2);}
\texttt{    return m + 1;}
\texttt{}}
\]

Answer: ____________________________
8. The Manhattan distance between points \((x_1, y_1)\) and \((x_2, y_2)\) in the plane is \(|x_1 - x_2| + |y_1 - y_2|\). (It tells how far you have to travel to get from \((x_1, y_1)\) to \((x_2, y_2)\) if you are restricted to walking horizontally or vertically.) Write a C++ definition of function ManhattanDistance\((x_1, y_1, x_2, y_2)\), which returns the Manhattan distance between points \((x_1, y_1)\) and \((x_2, y_2)\). You can use function abs from the library. Do not use sqrt.

Make this function do exactly its job and nothing more. It must not read or write anything. A heading is given.

\[
\text{int ManhattanDistance(int x1, int y1, int x2, int y2)}
\]

9. Write a C++ definition of function totalDistance\((x_1, y_1, x_2, y_2, x_3, y_3)\), which returns the total Manhattan distance traveled if you walk from \((x_1, y_1)\) to \((x_2, y_2)\) and then you walk from \((x_2, y_2)\) to \((x_3, y_3)\).

Use your function from the preceding problem. Do not use abs or sqrt for this function definition. A heading is given.

\[
\text{int totalDistance(int x1, int y1, int x2, int y2, int x3, int y3)}
\]

10. Write a C++ definition of function celsiusToFahrenheit\((t)\), which returns the Fahrenheit equivalent of Celsius temperature \(t\). Using common mathematical notation, the result is \((9/5)(t) + 32\). Be sure to write your definition in correct C++ notation. Make this function do exactly its job and nothing more. It must not read or write anything.

Make this function do exactly its job and nothing more. It must not read or write anything. A heading is given.

\[
\text{double FahrenheitToCelsius(const double t)}
\]