

Homework 2

PROBLEM SOLVING IN C
(CSCE 105, FALL 2005)

URL: <http://www.cse.unl.edu/~cstrobe/csce105f05/>

Due on 3rd October, 2005

19 September, 2005

Name :

Course No : **CSCE105**

Instructions:

For question 1, fill in the table with the your answers. For questions 2 through 6 put your answer in the provided answer box. For questions 7, 8, 9, and 10, turn in your source code using the WebHandin. **If you use a compiler other than those on CSE, make sure that your code works on CSE!**

1. (10 points) Evaluate each of the following expressions if `a` is 10, `b` is -5, `c` is 15, and `flag` is 1. Which parts of these expressions are not evaluated due to short-circuit evaluation. (Write short-circuited evaluation, or write “none” if nothing is short-circuited).

Expression:	Evaluates to:	short-circuit cut-off:
<code>c == b - a flag</code>		
<code>a != 10 !flag && c <= (-b * a)</code>		
<code>!(a % b) && b <= -5</code>		
<code>!(a > 15) c < a + b</code>		
<code>!!a == 10 && c > 15 b</code>		

2. (10 points) Convert each of the following from pseudocode to proper C statements.

<p>Answer Box:</p> <p>a. <code>x</code> is less than <code>y</code> and <code>y</code> is greater than <code>z</code></p> <p>b. <code>x</code> is greater than <code>y</code> and <code>x</code> is less than or equal to <code>z</code></p> <p>c. <code>x</code> is true and <code>y</code> is not equal to <code>z</code> or <code>z</code> is not equal to 42</p> <p>d. <code>x</code> is equal to <code>y</code> or <code>x</code> is equal to 1</p> <p>e. <code>x</code> is less than or equal to <code>y</code> and <code>y</code> is less than or equal to <code>z</code></p>	
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3. (10 points) Rewrite the following mathematical expressions using C functions:

Answer Box: a. $\sqrt{ z - 2.0 }$ b. $(x + y)^2 \times \log_{10}(e^x)$ c. $xyz / \sin(x)$ d. $ x^{3.14} - \sqrt[4]{4y} $	
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4. (10 points) Write a function called **distance** that takes as input four values **x_1**, **y_1**, **x_2**, and **y_2** that specify two Cartesian points (x_1, y_1) and (x_2, y_2) and returns the distance between them computed by using the formula:

$$distance = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Answer Box:

5. (10 points) Evaluate each of the following (using the function specifications in Chapter 3):

<p>Answer Box:</p> <p>a. <code>scale(512.442,5)</code></p> <p>b. <code>find_circum(4.2)</code></p> <p>c. <code>print_rboxed(find_circum(4.2))</code></p> <p>d. <code>find_area(15.0)</code></p> <p>e. <code>scale(find_area(44),3)</code></p>	
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6. (10 points) Write a function definition for a function called **average**. The function **average** has two inputs, both of them are type integer, and one return value of type double. The function **average** takes the two integer input arguments and prints the average of them as a double. The function then returns the average of them as a double.

Answer Box:

7. (10 points) Write two functions, one that displays a triangle and one that displays a rectangle. Use these functions to write a complete C program from the following outline:

```
int main (void) {
    /* Draw triangle */
    /* Draw rectangle */
    /* Display two blank lines */
    /* Draw triangle */
    /* Draw rectangle */
}
```

8. (10 points) In shopping for a new house, you must consider several factors. In this problem the initial cost of the house, the estimated annual fuel costs, and the annual tax rate are available. Write a program that will determine the total cost of a house after a five-year period and run the program for each of the following sets of data.

Initial house cost	Annual Fuel Cost	Tax Rate
67,000	2,300	0.025
62,000	2,500	0.025
75,000	1,850	0.020

To calculate the house cost, add the initial cost to the fuel cost for five years, then add the taxes for five years. Taxes for one year are computed by multiplying the tax rate by the initial cost. Write and call a function that displays instructions to the program user.

9. (10 points) Write a program to take a depth (in kilometers) inside the earth as input data; compute and display the temperature at this depth in degrees Celsius and degrees Fahrenheit. The relevant formulas are

$$Celsius = 10(depth) + 20,$$

for the Celsius temperature at depth in km, and

$$Fahrenheit = 1.8(Celsius) + 32$$

Include two functions in your program. Function `celsius_at_depth` should compute and return the Celsius temperature at a depth measured in kilometers. Function `fahrenheit` should convert a Celsius temperature to Fahrenheit.

10. (10 points) The table below shows the normal boiling points of several substances. Write a program that prompts the user for the observed boiling point of a substance in °C and identifies the substance if the observed boiling point is within 5% of the expected boiling point. If the data input is more than 5% higher or lower than any of the boiling points in the table, the program should output the message **Substance unknown**.

Substance	Normal boiling point (°C)
Water	100
Mercury	357
Copper	1187
Silver	2193
Gold	2660

Your program should define and call a function `within_x_percent` that takes as parameters a reference value `ref`, a data value `data`, and a percentage value `x` and returns 1 meaning true if `data` is within `x%` of `ref`, using the formula $(\text{ref} - x\% * \text{ref}) \leq \text{data} \leq (\text{ref} + x\% * \text{ref})$. Otherwise, `within_x_percent` would return zero, meaning false. For example, `within_x_percent(357,323,10)` would return true, since 10% of 357 is 35.7, and 323 falls between 321.3 and 392.7.

Due: October 3, 2005

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Question	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
Total:	100	