

LAB ASSIGNMENTS

Problem Solving and Program Design Using C (CSE 3942)



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Lab Assignment-1

1. Programming Projects on Overview of C

- 1.1 Write a program that calculates mileage reimbursement for a salesperson at a rate of \$.35 per mile. Your program should interact with the user in this manner: MILEAGE REIMBURSEMENT CALCULATOR

Enter beginning odometer reading=> 13505.2

Enter ending odometer reading=> 13810.6

You traveled 305.4 miles. At \$.35 per mile,
your reimbursement is \$106.89.

- 1.2 Write a program to assist in the design of a hydroelectric dam. Prompt the user for the height of the dam and for the number of cubic meters of water that are projected to flow from the top to the bottom of the dam each second. Predict how many megawatts ($1\text{MW} = 10^6\text{W}$) of power will be produced if 90% of the work done on the water by gravity is converted to electrical energy. Note that the mass of one cubic meter of water is 1000 kg. Use $9.80\text{ meters/second}^2$ as the gravitational constant g . Be sure to use meaningful names for both the gravitational constant and the 90% efficiency constant. For one run, use a height of 170 m and flow of $1.30 \times 10^3\text{ m}^3/\text{s}$. The relevant formula ($w = \text{work}$, $m = \text{mass}$, $g = \text{gravity}$, $h = \text{height}$) is: $w = mgh$.

- 1.3 Write a program that estimates the temperature in a freezer (in $^{\circ}\text{C}$) given the elapsed time (hours) since a power failure. Assume this temperature (T) is given by

$$T = \frac{4t^2}{t + 2} - 20$$

where t is the time since the power failure. Your program should prompt the user to enter how long it has been since the start of the power failure in whole hours and minutes. Note that you will need to convert the elapsed time into hours. For example, if the user entered 2 30 (2 hours 30 minutes), you would need to convert this to 2.5 hours.

- 1.4 Write a program to convert a temperature in degrees Fahrenheit to degrees Celsius.

DATA REQUIREMENTS

Problem Input

int fahrenheit /* temperature in degrees Fahrenheit */

Problem Output

double celsius /* temperature in degrees Celsius */

Relevant Formula

celsius = $5/9$ (fahrenheit - 32)

- 1.5 Metro City Planners proposes that a community conserve its water supply by replacing all the community's toilets with low-flush models that use only 2 liters per flush. Assume that there is about 1 toilet for every 3 persons, that existing toilets use an average of 15 liters per flush, that a toilet is flushed on average 14 times per day, and that the cost to install each new toilet is \$150. Write a program that would estimate the magnitude (liters/day) and cost of the water saved based on the community's population.
- 1.6 Write a program that takes the length and width of a rectangular yard and the length and width of a rectangular house situated in the yard. Your program should compute the time required to cut the grass at the rate of two square feet a second.

Lab Assignment-2

2. Programming project on Top-Down Design With Functions

- 2.1 You have saved \$500 to use as a down payment on a car. Before beginning your car shopping, you decide to write a program to help you figure out what your monthly payment will be, given the car's purchase price, the monthly interest rate, and the time period over which you will pay back the loan. The formula for calculating your payment is

$$\text{payment} = \frac{iP}{1 - (1 + i)^{-n}}$$

where P = principal (the amount you borrow)

i = monthly interest rate ($\frac{1}{12}$ of the annual rate)

n = total number of payments

Your program should prompt the user for the purchase price, the down payment, the annual interest rate and the total number of payments (usually 36, 48, or 60). It should then display the amount borrowed and the monthly payment including a dollar sign and two decimal places.

- 2.2 Four track stars have entered the mile race at the Penn Relays. Write a program that scans in the race time in minutes (minutes) and seconds (seconds) for a runner and computes and displays the speed in feet per second (fps) and in meters per second (mps). (Hints: There are 5,280 feet in one mile, and one kilometer equals 3,282 feet.) Write and call a function that displays instructions to the program user. Run the program for each star's data.

Minutes	Seconds
3	52.83
3	59.83
4	00.03
4	16.22

- 2.3 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.

- 2.4 A cyclist coasting on a level road slows from a speed of 10 mi/hr to 2.5 mi/hr in one minute. Write a computer program that calculates the cyclist's constant rate of acceleration and determines how long the cyclist will take to come to rest, given an initial speed of 10 mi/hr. (Hint: Use the equation

$$a = \frac{v_f - v_t}{t}$$

where a is acceleration, t is time interval, v_1 is initial velocity, and v_f is final velocity.) Write and call a function that displays instructions to the program user and a function that computes a , given t , v_f , and v_r .

- 2.5 A manufacturer wishes to determine the cost of producing an open-top cylindrical container. The surface area of the container is the sum of the area of the circular base plus the area of the outside (the circumference of the base times the height of the container). Write a program to take the radius of the base, the height of the container, the cost per square centimeter of the material (cost), and the number of containers to be produced (quantity). Calculate the cost of each container and the total cost of producing all the containers. Write and call a function that displays instructions to the user and a function that computes surface area.
- 2.6 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

$$\text{Celsius} = 10 (\text{depth}) + 20 \quad (\text{Celsius temperature at depth in km})$$

$$\text{Fahrenheit} = 1.8 (\text{Celsius}) + 32$$

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.