



## LM Software Workshop 1 (34153, 34182, 34168, 36990)

### Lab Exercise Sheet

#### Week 1-Chap 2 (Software development data types and expressions)

1. The tax calculator program of the case study outputs a floating-point number that might show more than two digits of precision. Use the round function to modify the program to display at most two digits of precision in the output number.

##### Request

The customer requests a program that computes a person's income tax.

##### Analysis

Analysis often requires the programmer to learn some things about the problem domain, in this case, the relevant tax law. For the sake of simplicity, let's assume the following tax laws:

- All taxpayers are charged a flat tax rate of 20%.
- All taxpayers are allowed a \$10,000 standard deduction.
- For each dependent, a taxpayer is allowed an additional \$3,000 deduction.
- Gross income must be entered to the nearest penny.
- The income tax is expressed as a decimal number.

Another part of analysis determines what information the user will have to provide. In this case, the user inputs are gross income and number of dependents. The program calculates the income tax based on the inputs and the tax law and then displays the income tax. Figure 2-4 shows the proposed terminal-based interface. Characters in *italics* indicate user inputs. The program prints the rest. The inclusion of an interface at this point is a good idea because it allows the customer and the programmer to discuss the intended program's behavior in a context understandable to both.

```
Enter the gross income: 150000.00
Enter the number of dependents: 3
The income tax is $26200.0
```

2. You can calculate the surface area of a cube if you know the length of an edge. Write a program that takes the length of an edge (an integer) as input and prints the cube's surface area as output.
3. Five Star Retro Video rents VHS tapes and DVDs to the same connoisseurs who like to buy LP record albums. The store rents new videos for \$3.00 a night, and oldies for \$2.00 a night. Write a program that the clerks at Five Star Retro Video can use to calculate the total charge for a customer's video rentals. The program should prompt the user for the number of each type of video and output the total cost.
4. Write a program that takes the radius of a sphere (a floating-point number) as input and then outputs the sphere's diameter, circumference, surface area, and volume.
5. An object's momentum is its mass multiplied by its velocity. Write a program that accepts an object's mass (in kilograms) and velocity (in meters per second) as inputs and then outputs its momentum.
6. The kinetic energy of a moving object is given by the formula  $KE = \frac{1}{2}mv^2$  where  $m$  is the object's mass and  $v$  is its velocity. Modify the program you created in Project 5 so that it prints the object's kinetic energy as well as its momentum.
7. Write a program that calculates and prints the number of minutes in a year.
8. Light travels at  $3 \times 10^8$  meters per second. A light-year is the distance a light beam travel in

one year. Write a program that calculates and displays the value of a light-year.

9. Write a program that takes as input a number of kilometers and prints the corresponding number of nautical miles. Use the following approximations:
  - A kilometer represents  $1/10,000$  of the distance between the North Pole and the equator.
  - There are 90 degrees, containing 60 minutes of arc each, between the North Pole and the equator.
  - A nautical mile is 1 minute of an arc.
10. An employee's total weekly pay equals the hourly wage multiplied by the total number of regular hours plus any overtime pay. Overtime pay equals the total overtime hours multiplied by 1.5 times the hourly wage. Write a program that takes as inputs the hourly wage, total regular hours, and total overtime hours and displays an employee's total weekly pay.

hours