Lab Excersize #2 - Standard I/O, Math, and if/else

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ELEC2850 Microcontrollers Using C Programming

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1 Problem Statement

Create a program that estimates the shipping costs for a quantity of washers. It must be based on the weight of the specified washer. To find the weight of the washer, you must calculate it from the users input of: inner diameter, outer diameter, thickness, material density, and quantity ordered. If the user wants expedited shipping, the program must add an additional 12% to the total cost and tell the user the shipping speed.

2 Flowchart

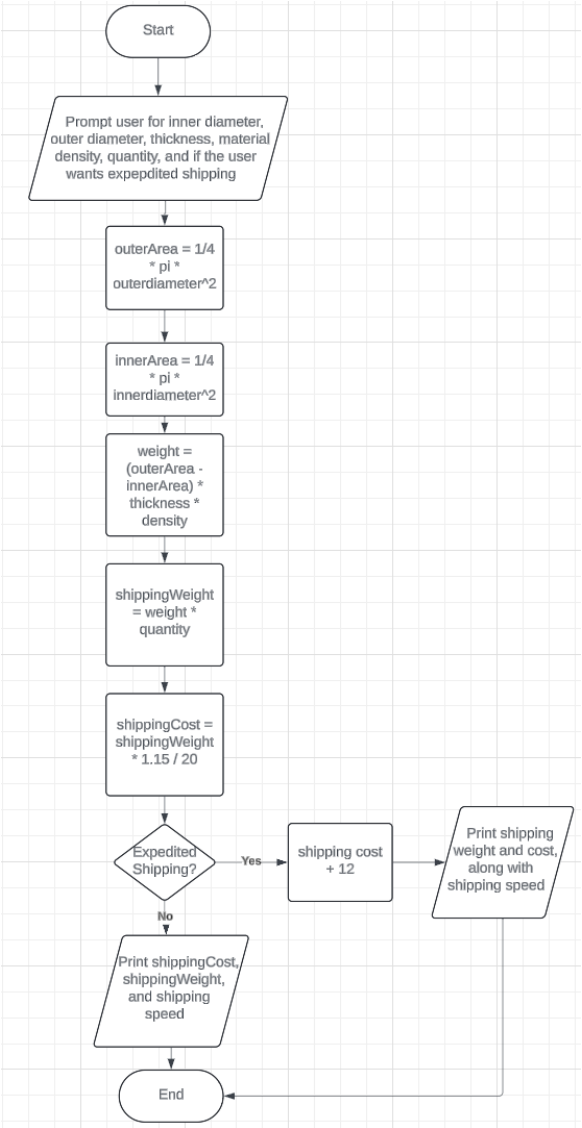

Figure 1: Output without expedited shipping

3 Output

```
Enter the inner diameter of the washer: 1.2
Enter the outer diameter of the washer: 2.4
Enter the thickness of the washer: 0.1
Enter the material density in grams per cubic centimeter: 7.87
Enter the quantity of washers: 1000
Do you want expedited shipping (1 for yes, 0 for no): 0
The shipping weight of the washers is 2670.23 grams.
The shipping cost of the washers is $153.54.
Shipping Speed: Standard
```

Figure 2: Output without expedited shipping

```
Enter the inner diameter of the washer: 1.2
Enter the outer diameter of the washer: 2.4
Enter the thickness of the washer: 0.1
Enter the material density in grams per cubic centimeter: 7.87
Enter the quantity of washers: 1000
Do you want expedited shipping (1 for yes, 0 for no): 1
The shipping weight of the washers is 2670.23 grams.
The shipping cost of the washers is $165.54.
Shipping Speed: Expedited
```

Figure 3: Output with expedited shipping

4 Code

```c
#include <stdio.h>

void main()
{
  float innerDiameter, outerDiameter, thickness, density = 0;            // declare variables
  int shipping, quantity = 0;                                            // declare variables
  printf("Enter the inner diameter of the washer: ");                    // prompt user for inner diameter
  scanf("%f", &innerDiameter);                                           // store inner diameter in variable
  printf("Enter the outer diameter of the washer: ");                    // prompt user for outer diameter
  scanf("%f", &outerDiameter);                                           // store outer diameter in variable
  printf("Enter the thickness of the washer: ");                         // prompt user for thickness
  scanf("%f", &thickness);                                               // store thickness in variable
  printf("Enter the material density in grams per cubic centimeter: ");  // prompt user for density
  scanf("%f", &density);                                                 // store density in variable
  printf("Enter the quantity of washers: ");                             // prompt user for quantity
  scanf("%d", &quantity);                                                // store quantity in variable
  printf("Do you want expedited shipping (1 for yes, 0 for no): ");      // prompt user for shipping preference
  scanf("%d", &shipping);                                                // store shipping preference in variable
  float outerArea = 0.25 * 3.14159 * (outerDiameter * outerDiameter);    // calculate outer area 1/4 * pi * d^2
  float innerArea = 0.25 * 3.14159 * (innerDiameter * innerDiameter);    // calculate inner area 1/4 * pi * d^2
  float weight = (outerArea - innerArea) * thickness * density;          // calculate weight of one washer
```

```
22    float shippingWeight = weight * quantity;                    // calculate weight of washers
        ordered
23    float shippingCost = shippingWeight * 1.15 / 20;              // calculate shipping cost
24    printf("The shipping weight of the washers is %.2f grams.\n", shippingWeight); // print user the
        weight of the washers shipped
25    if (shipping == 1)
26    {                                    // if user wants expedited shipping
27      shippingCost += 12;                          // add $12 to shipping cost
28      printf("The shipping cost of the washers is $%.2f.\n", shippingCost); // print user the shipping
         cost
29      printf("Shipping Speed: Expedited\n");               // print user the shipping speed
30    }
31    else
32    {                                    // if user doesn't want expedited shipping
33      printf("The shipping cost of the washers is $%.2f.\n", shippingCost); // print user the shipping
         cost
34      printf("Shipping Speed: Standard\n");              // print user the shipping speed
35    }
36  }
```