GNG1106 Winter 2019 - Assignment 2

Posted: Jan 28

Due: Sun Feb 3, 23:59

Instructions

This assignment is to be done INDIVIDUALLY. Use the following instructions to complete and submit this assignment.

- You will need to submit your assignment electronically to Brightspace. Prepare the following
    - An assignment file in a PDF file (this allows you to use your favorite editor to create the PDF file). For question 1, insert the programming models for parts (a) and (b) filled in as per the question instructions. You may fill in the programming model using drawing features of your editor or by hand on paper which is then scanned and inserted into your document. For Question 2, insert in your assignment file the source code (take care in its appearance), and capture the output from running the program for all test cases. Also submit your **source code** files for question 2.
- Place all your files (PDF file and C source code files) in a directory A2_xxxxxxxx where xxxxxxxx et your student number.
- Zip your PDF document and the C source files in a zip file with the name A2_xxxxxx.zip where xxxxxx is your student.
- Submit the zip file before the assignment deadline via Brightspace. In Brightspace, navigate to the Assignment page and click on "Click to submit Assignment 2" to reach the assignment 2 submission folder. You can also select the Assignment tab to see the Assignment folder pages. The Brightspace video "Assignments" (found in the page https://documentation.brightspace.com/EN/le/assignments/learner/submit_assignments.htm) provides details to help you submit the zip file.
- The questions are provided in both PDF and Word files. You may use the Word file to enter your answers in the document. An rtf file is also provided so that you may edit the file with a word processor other than Word. Be sure to submit a **PDF** file.
- It is NOT permitted to use instructions such as branches and loops that have not yet been covered in the lectures.

➢ Do start the assignment soon and do not wait until the last minute. You will be more efficient with a number of smaller efforts over a few weeks before the deadline than one large effort just before the deadline.

Marking Scheme (total 30 marks)

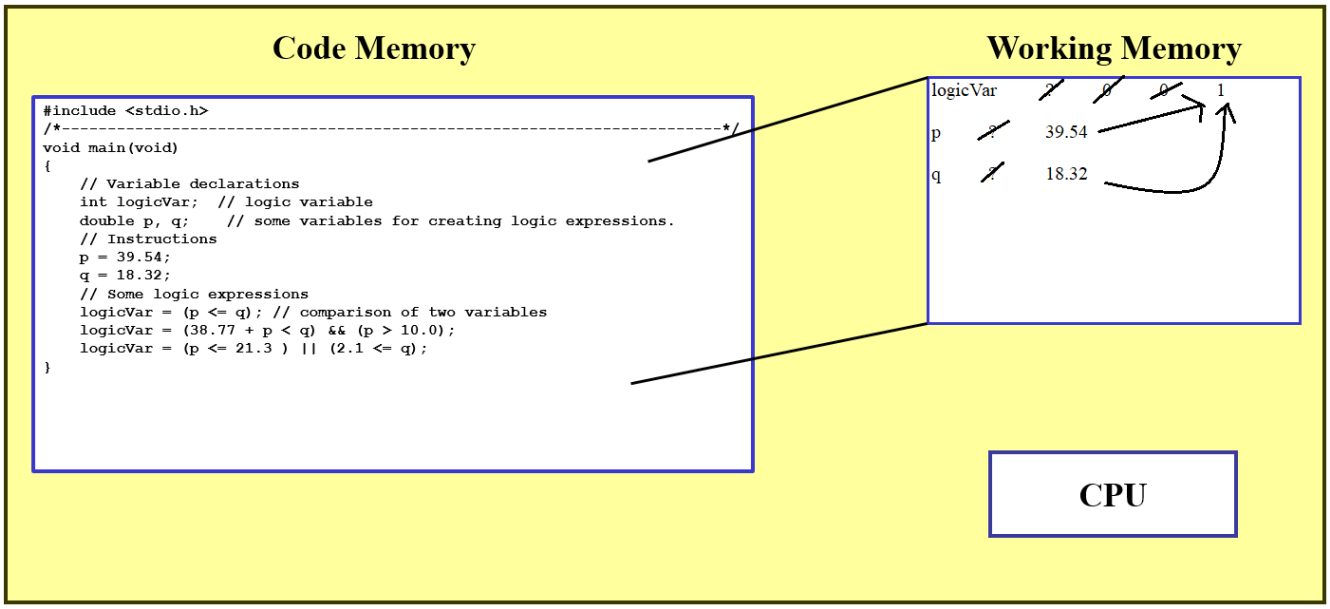
- Question 1: 15 marks
- Question 2: 15 marks

Question 1 (15 marks)

(a) (5 marks) The following programming model contains in its code memory the indicated C program composed of a single main function. You will be showing how the working memory is used during the execution of main. Show how the given C program affects the contents of the working memory:

- Show the values are assigned to the variables. Be sure to show all values that are assigned and replaced. Record successive assignments to variables/parameters as follows:

Variable nam ? \ 2, 6, 4, 10

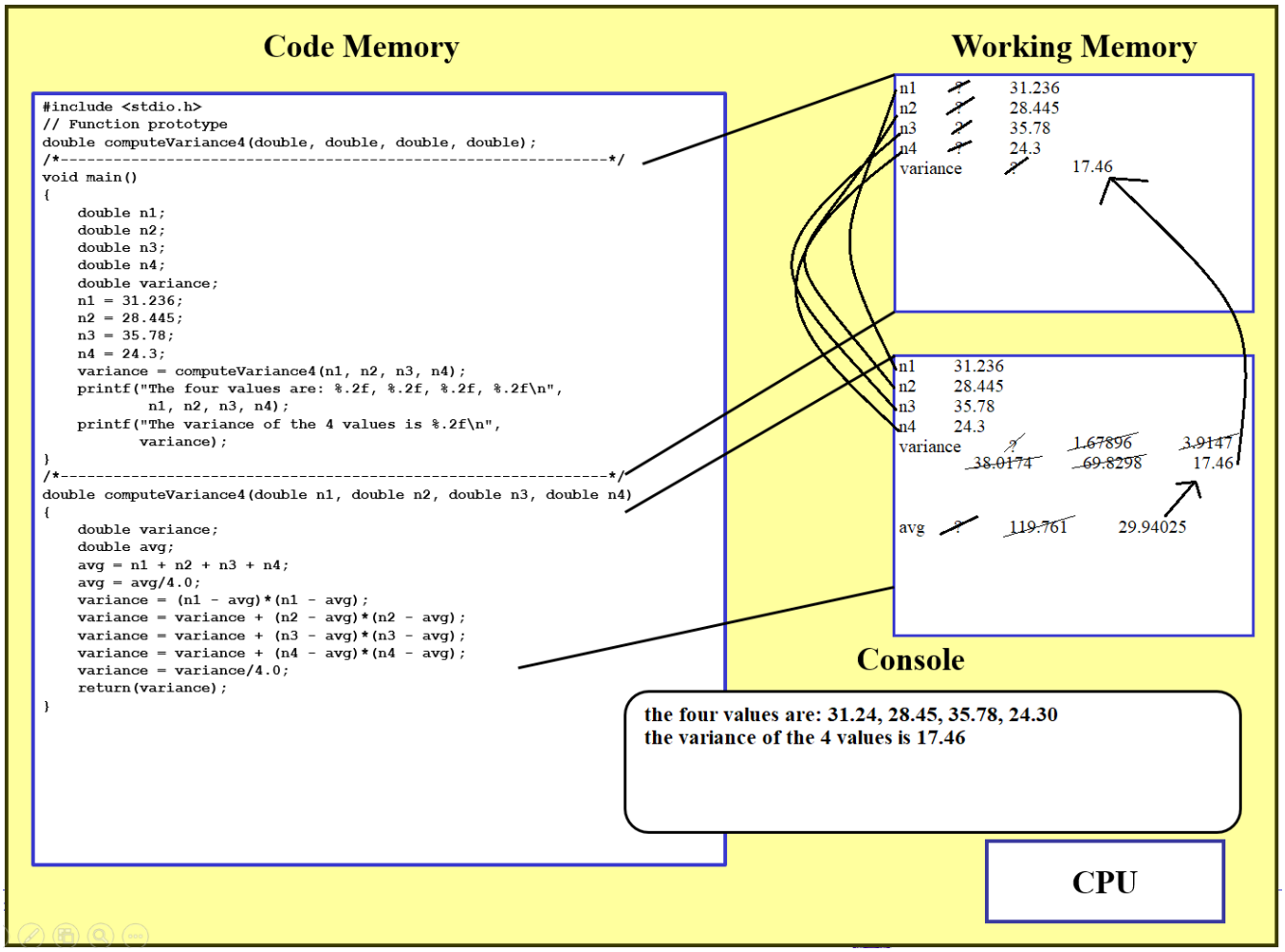


(b) (10 marks) The following programming model contains in its code memory the indicated C program composed of 2 functions. You must show how the working memory is used during the execution of the two functions. Each piece of working memory is associated to a function using a pair of lines. (Note: the first pair of lines associates the piece of working memory allocated to the function **main** and the second pair of lines associates the piece allocated to the function **computeVariance4**). Show how the given C program affects the contents of the working memory:

- Show the values are assigned to variables. Be sure to show all values that are assigned and replaced. Record successive assignments to variables/parameters as follows:

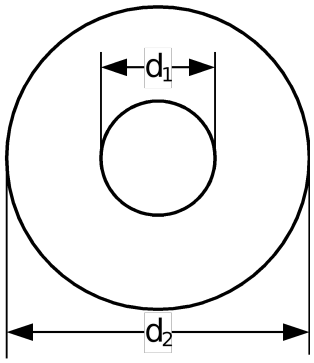
Variable name: ~~?~~, ~~2~~, ~~6~~, ~~4~~, 10

- Using arrows show how values are copied between the working memory allocated to the function **main** and the working memory allocated to the function **computeNetResistance**.
- In the console window show the output of the program.



Note: You do NOT need to show how the CPU interacts with memory.

Question 2 (15 marks)
You must develop a program that calculates the weight of a number of flat washers with the following dimensions.



The given dimension of the washer is given by its thickness (x), the external diameter (d_2) and the hole diameter (d_1). Thus the area of the washer is given by $a = \pi(d_2 / 2)^2 - \pi(d_1 / 2)^2$.

The volume, *v*, of the washer is given by $v = xa$.

The weight, *w*, of the washer is given by $w = vd$

where *d* is the density of washer`s material. From these equations, the weight w_n of *n* washers is given by

$$w_n = nw = nvd = nxad = nxd\left(\pi(d_2 / 2)^2 - \pi(d_1 / 2)^2\right)$$

$$= \frac{nxd\pi(d_2^2 - d_1^2)}{4}$$

Develop a program that requests from the user the following data

- The number *n* of washers,
- The density of the washer's material, in kg/cm^3,
- The thickness *x* of the washer, in centimeters (cm),
- The external diameter, d_2, of the washer in cm,
- The diameter of the hole, d_1, of the washer in cm.

- For the `main` function
  - Obtains the data from the user and save them in appropriate variables.
  - Calls the function `totalWeight` to compute weight of the *n* flat washers.
  - Display results to the user in a message (see the following example) that includes data input by the user and the weight of the washers. Format the output values to display at most the number of digits in the fractional part of the real values shown the message example.

```
The washer characteristics are
  Density: 0.00260 kg/cm^3
  Thickness: 0.030 cm
  External diameter: 0.500 cm
```

```
  Diameter of the hole: 0.230 cm
The weight of 1 washers is 1.21e-005 kg.
```

- For the function `totalWeight`
  - Define parameters to receive the data input by the user.
  - Define local variable for storing the total weight, w_n.
  - Note that the math header file, *math.h*, provides the symbolic constant M_PI for the value of π.

  - Instead of using a single instruction to compute the force value, use a number of instructions to "accumulate" values into the variable w_n as follows. Note that these are not true mathematical equations but show how w_n as a computer variable can accumulate intermediate values during the computation.

$w_n = d_2^2 - d_1^2$ Assigns to w_n the value of $x^2 + a^2$

$w_n = nxd\pi w_n$ Assigns to w_n the value of $nxd\pi(d_2^2 - d_1^2)$

$w_n = w_n/4$ Assigns to w_n the value of $\dfrac{nxd\pi(d_2^2 - d_1^2)}{4}$

The following table gives the density of different metals and plastics that can be used in the production of flat washers:

Métal	**Density in kg/cm³**
Aluminium	0.0026
Brass	0.0085
Bronze (8-14% tin)	0.0074 to 0.0089
Iron	0.00787
Stainless steel	0.00748 to 0.00795
Plastic	**Density in kg/cm³**
Polyethylene (low density)	0.00091 to 0.00094
Polyethylene (high density)	0.00094 à 0.00096

(Source: https://www.globalplasticsheeting.com/our-blog-resource-library/bid/72325/Density-of-Polyethylene).

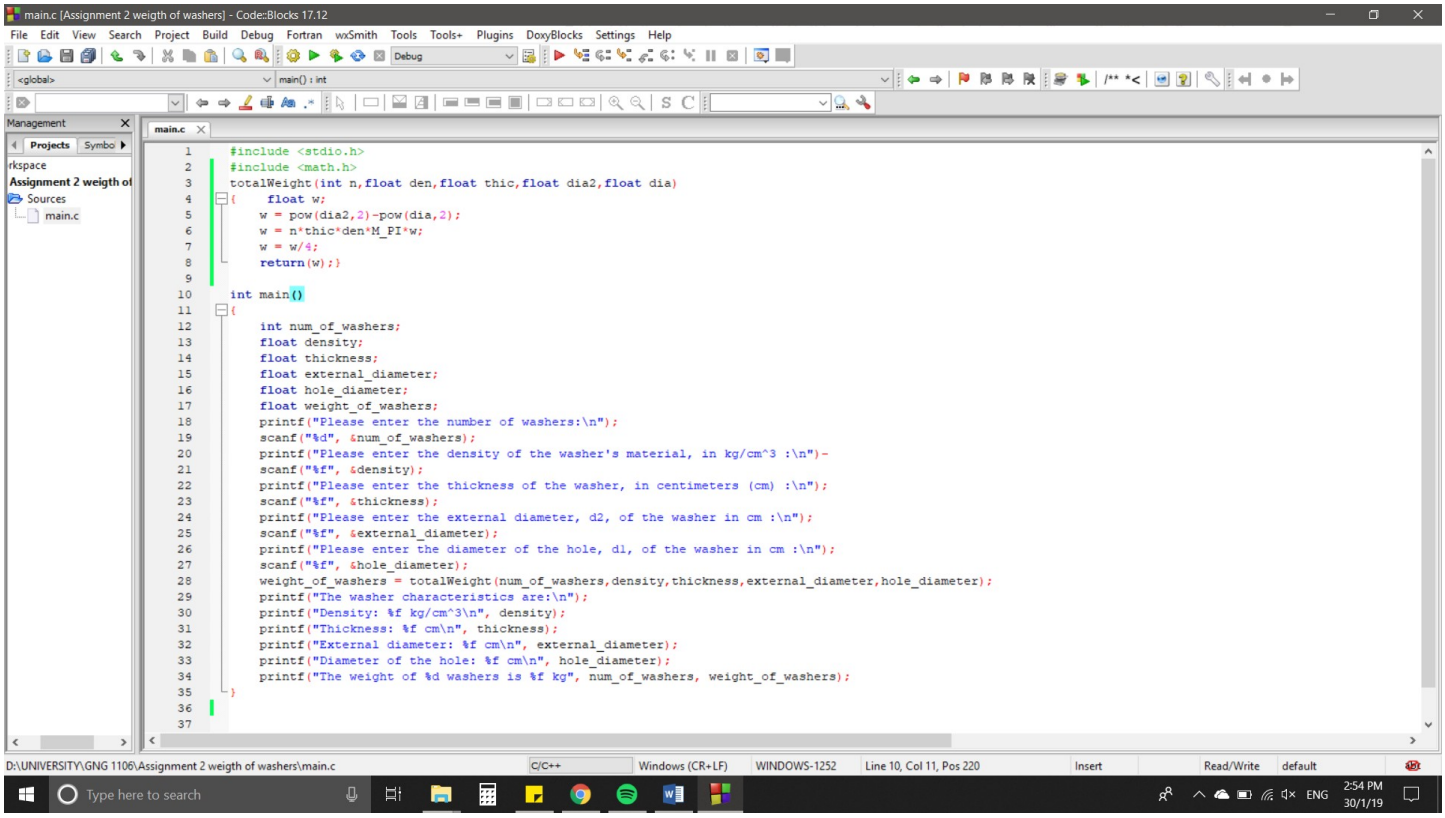
The following table presents test cases to be used for testing your program. Note that intermediate values for w_n are provided to allow you to trace your program to debug any problems.

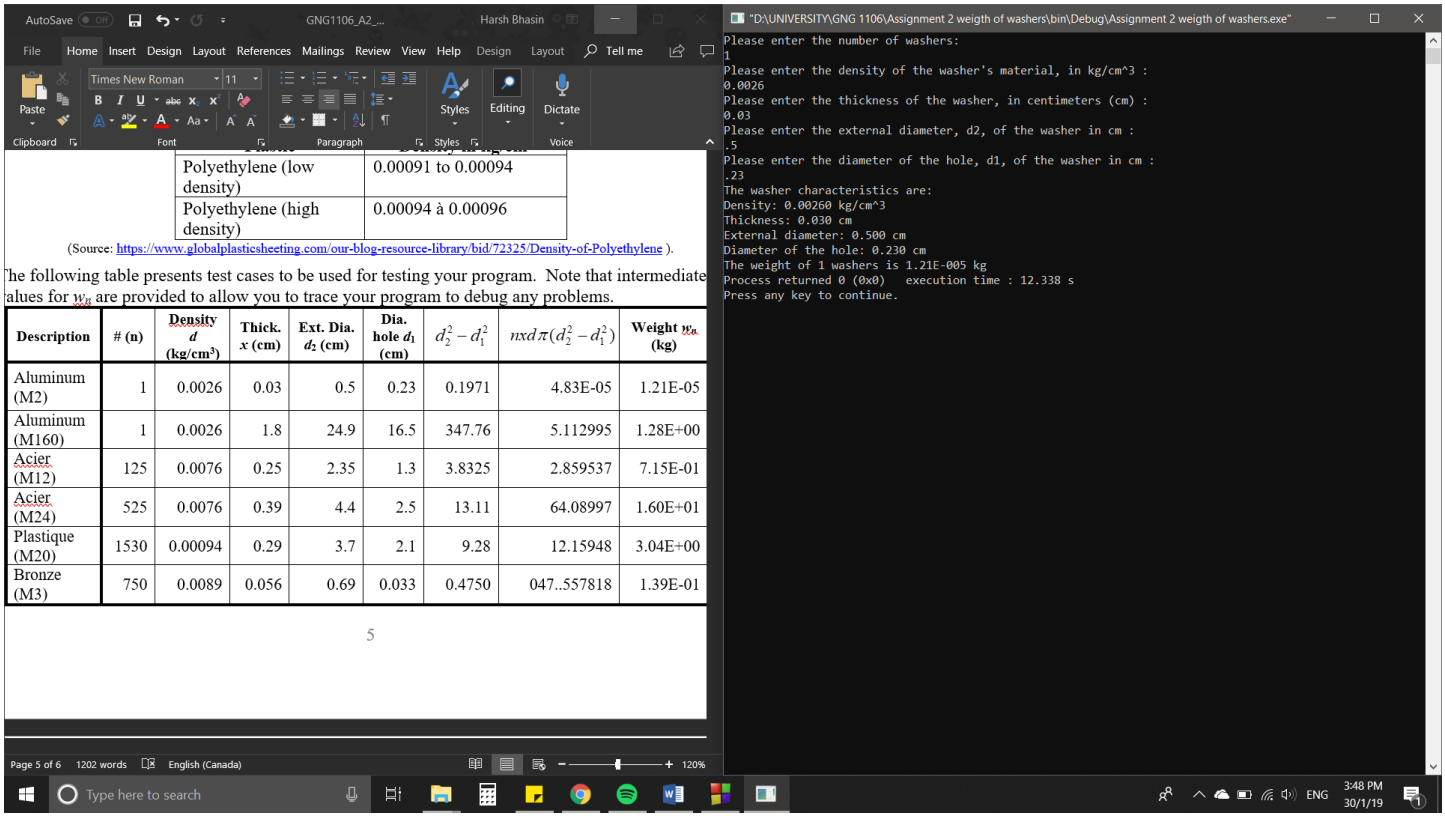
Description	**# (n)**	**Density *d* (kg/cm³)**	**Thick. *x* (cm)**	**Ext. Dia. d_2 (cm)**	**Dia. hole d_1 (cm)**	$d_2^2 - d_1^2$	$nxd\pi(d_2^2 - d_1^2)$	**Weight w_n (kg)**
Aluminum (M2)	1	0.0026	0.03	0.5	0.23	0.1971	4.83E-05	1.21E-05
Aluminum (M160)	1	0.0026	1.8	24.9	16.5	347.76	5.112995	1.28E+00
Acier (M12)	125	0.0076	0.25	2.35	1.3	3.8325	2.859537	7.15E-01
Acier (M24)	525	0.0076	0.39	4.4	2.5	13.11	64.08997	1.60E+01

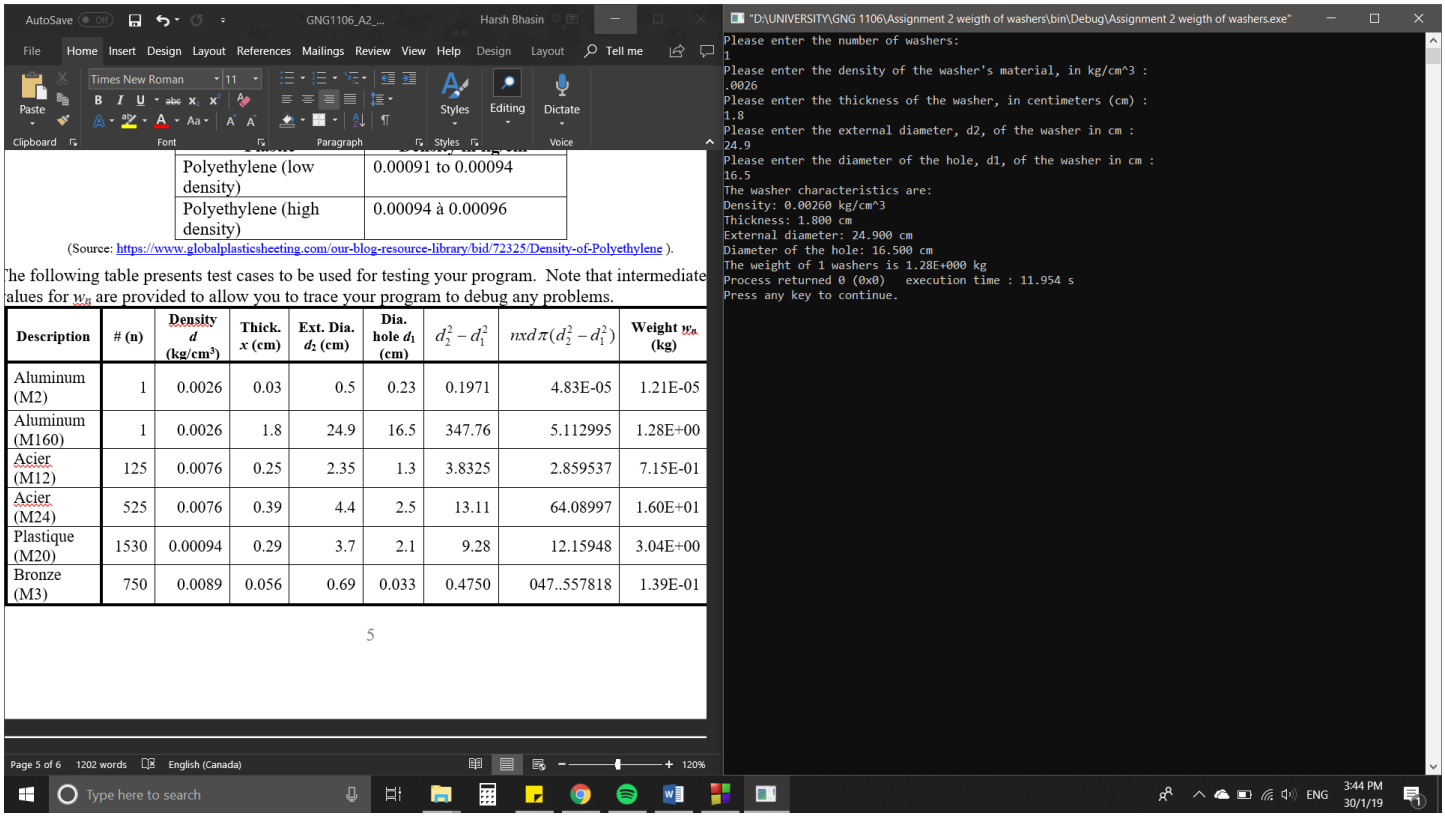
Plastique (M20)	1530	0.00094	0.29	3.7	2.1	9.28	12.15948	3.04E+00
Bronze (M3)	750	0.0089	0.056	0.69	0.033	0.4750	047..557818	1.39E-01

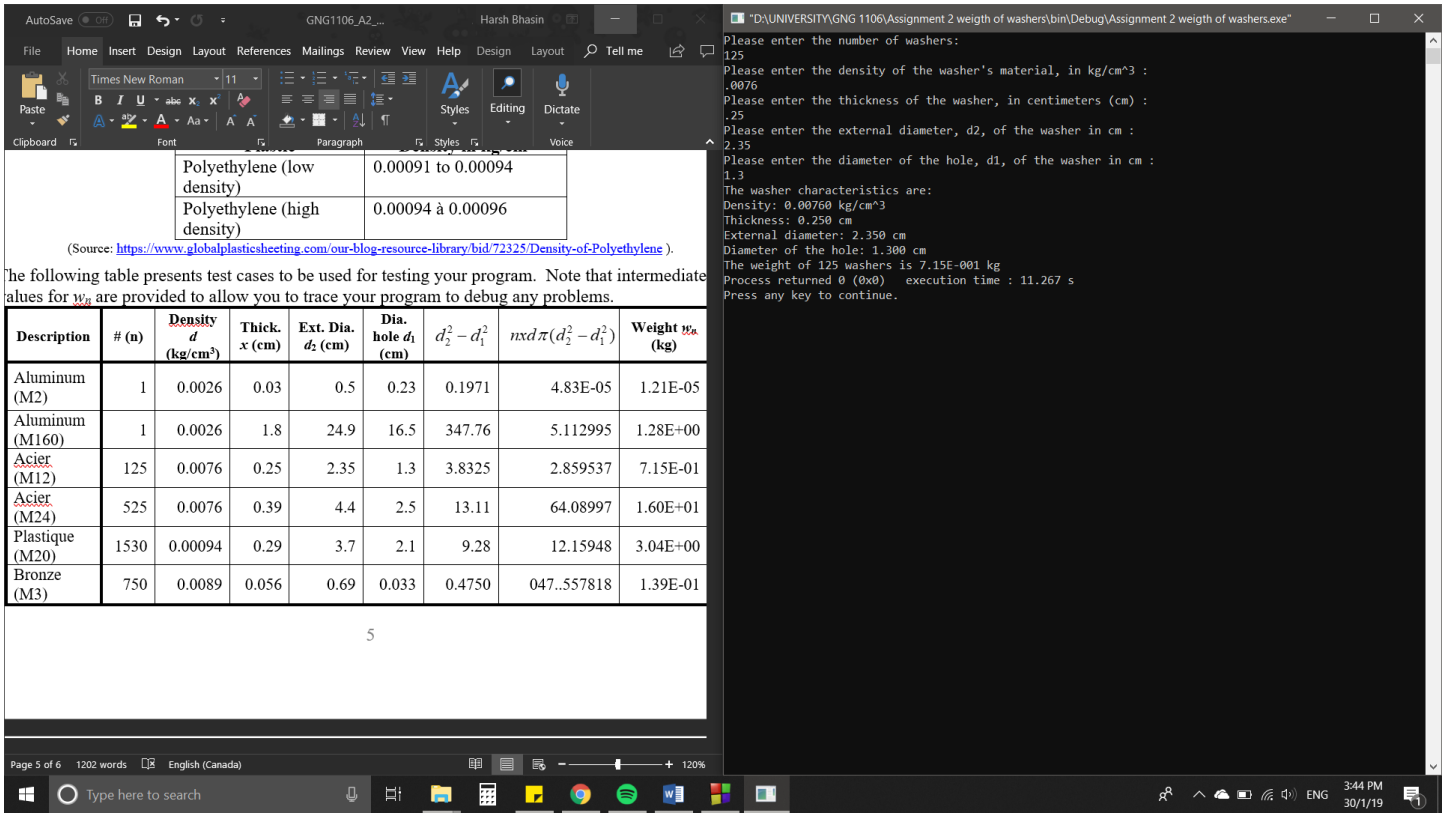
The answer to this question should provide:

1) The source code to your program (also insert the source code into the assignment file).
2) The output showing the results of all the test cases; insert the output into the assignment file.


main.c [Assignment 2 weigth of washers] - Code::Blocks 17.12
File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help
Debug
<global>
main() : int
Management
Projects
Symbo
rkspace
Assignment 2 weigth of
Sources
main.c
main.c
#include <stdio.h>
#include <math.h>
totalWeight(int n,float den,float thic,float dia2,float dia)
{ float w;
w = pow(dia2,2)-pow(dia,2);
w = n*thic*den*M_PI*w;
w = w/4;
return(w);}
int main()
{
int num_of_washers;
float density;
float thickness;
float external_diameter;
float hole_diameter;
float weight_of_washers;
printf("Please enter the number of washers:\n");
scanf("%d", &num_of_washers);
printf("Please enter the density of the washer's material, in kg/cm^3 :\n")-
scanf("%f", &density);
printf("Please enter the thickness of the washer, in centimeters (cm) :\n");
scanf("%f", &thickness);
printf("Please enter the external diameter, d2, of the washer in cm :\n");
scanf("%f", &external_diameter);
printf("Please enter the diameter of the hole, d1, of the washer in cm :\n");
scanf("%f", &hole_diameter);
weight_of_washers = totalWeight(num_of_washers,density,thickness,external_diameter,hole_diameter);
printf("The washer characteristics are:\n");
printf("Density: %f kg/cm^3\n", density);
printf("Thickness: %f cm\n", thickness);
printf("External diameter: %f cm\n", external_diameter);
printf("Diameter of the hole: %f cm\n", hole_diameter);
printf("The weight of %d washers is %f kg", num_of_washers, weight_of_washers);
}
D:\UNIVERSITY\GNG 1106\Assignment 2 weigth of washers\main.c
C/C++
Windows (CR+LF)
WINDOWS-1252
Line 10, Col 11, Pos 220
Insert
Read/Write
default
Type here to search
ENG
2:54 PM
30/1/19


AutoSave
GNG1106_A2_...
Harsh Bhasin
File Home Insert Design Layout References Mailings Review View Help Design Layout Tell me
Paste
Times New Roman
11
Styles
Editing
Dictate
Clipboard
Font
Paragraph
Styles
Voice
Polyethylene (low density) 0.00091 to 0.00094
Polyethylene (high density) 0.00094 à 0.00096
(Source: https://www.globalplasticsheeting.com/our-blog-resource-library/bid/72325/Density-of-Polyethylene).
The following table presents test cases to be used for testing your program. Note that intermediate values for w_n are provided to allow you to trace your program to debug any problems.
Description | # (n) | Density d (kg/cm3) | Thick. x (cm) | Ext. Dia. d2 (cm) | Dia. hole d1 (cm) | $d_2^2 - d_1^2$ | $nxd\pi(d_2^2 - d_1^2)$ | Weight w_n (kg)
Aluminum (M2) | 1 | 0.0026 | 0.03 | 0.5 | 0.23 | 0.1971 | 4.83E-05 | 1.21E-05
Aluminum (M160) | 1 | 0.0026 | 1.8 | 24.9 | 16.5 | 347.76 | 5.112995 | 1.28E+00
Acier (M12) | 125 | 0.0076 | 0.25 | 2.35 | 1.3 | 3.8325 | 2.859537 | 7.15E-01
Acier (M24) | 525 | 0.0076 | 0.39 | 4.4 | 2.5 | 13.11 | 64.08997 | 1.60E+01
Plastique (M20) | 1530 | 0.00094 | 0.29 | 3.7 | 2.1 | 9.28 | 12.15948 | 3.04E+00
Bronze (M3) | 750 | 0.0089 | 0.056 | 0.69 | 0.033 | 0.4750 | 047..557818 | 1.39E-01
5
Page 5 of 6 1202 words English (Canada) 120%
"D:\UNIVERSITY\GNG 1106\Assignment 2 weigth of washers\bin\Debug\Assignment 2 weigth of washers.exe"
Please enter the number of washers:
1
Please enter the density of the washer's material, in kg/cm^3 :
0.0026
Please enter the thickness of the washer, in centimeters (cm) :
0.03
Please enter the external diameter, d2, of the washer in cm :
.5
Please enter the diameter of the hole, d1, of the washer in cm :
.23
The washer characteristics are:
Density: 0.00260 kg/cm^3
Thickness: 0.030 cm
External diameter: 0.500 cm
Diameter of the hole: 0.230 cm
The weight of 1 washers is 1.21E-005 kg
Process returned 0 (0x0) execution time : 12.338 s
Press any key to continue.
Type here to search
ENG
3:48 PM
30/1/19


AutoSave
GNG1106_A2_...
Harsh Bhasin
File Home Insert Design Layout References Mailings Review View Help Design Layout Tell me
Paste
Times New Roman
11
Styles
Editing
Dictate
Clipboard
Font
Paragraph
Styles
Voice
Polyethylene (low density) 0.00091 to 0.00094
Polyethylene (high density) 0.00094 à 0.00096
(Source: https://www.globalplasticsheeting.com/our-blog-resource-library/bid/72325/Density-of-Polyethylene).
The following table presents test cases to be used for testing your program. Note that intermediate values for w_n are provided to allow you to trace your program to debug any problems.
Description | # (n) | Density d (kg/cm3) | Thick. x (cm) | Ext. Dia. d2 (cm) | Dia. hole d1 (cm) | $d_2^2 - d_1^2$ | $nxd\pi(d_2^2 - d_1^2)$ | Weight w_n (kg)
Aluminum (M2) | 1 | 0.0026 | 0.03 | 0.5 | 0.23 | 0.1971 | 4.83E-05 | 1.21E-05
Aluminum (M160) | 1 | 0.0026 | 1.8 | 24.9 | 16.5 | 347.76 | 5.112995 | 1.28E+00
Acier (M12) | 125 | 0.0076 | 0.25 | 2.35 | 1.3 | 3.8325 | 2.859537 | 7.15E-01
Acier (M24) | 525 | 0.0076 | 0.39 | 4.4 | 2.5 | 13.11 | 64.08997 | 1.60E+01
Plastique (M20) | 1530 | 0.00094 | 0.29 | 3.7 | 2.1 | 9.28 | 12.15948 | 3.04E+00
Bronze (M3) | 750 | 0.0089 | 0.056 | 0.69 | 0.033 | 0.4750 | 047..557818 | 1.39E-01
5
Page 5 of 6 1202 words English (Canada) 120%
"D:\UNIVERSITY\GNG 1106\Assignment 2 weigth of washers\bin\Debug\Assignment 2 weigth of washers.exe"
Please enter the number of washers:
1
Please enter the density of the washer's material, in kg/cm^3 :
.0026
Please enter the thickness of the washer, in centimeters (cm) :
1.8
Please enter the external diameter, d2, of the washer in cm :
24.9
Please enter the diameter of the hole, d1, of the washer in cm :
16.5
The washer characteristics are:
Density: 0.00260 kg/cm^3
Thickness: 1.800 cm
External diameter: 24.900 cm
Diameter of the hole: 16.500 cm
The weight of 1 washers is 1.28E+000 kg
Process returned 0 (0x0) execution time : 11.954 s
Press any key to continue.
Type here to search
ENG
3:44 PM
30/1/19



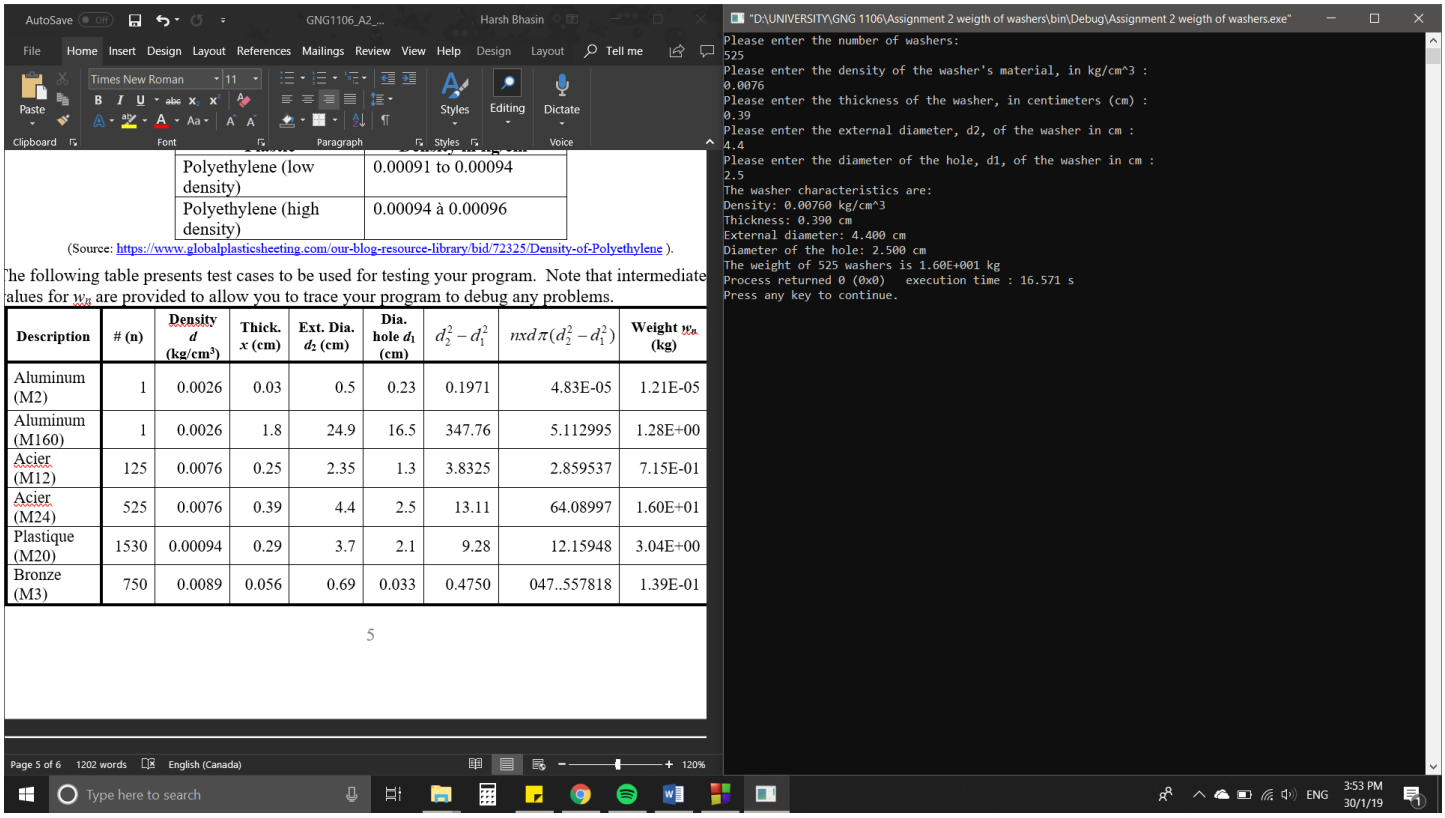
Polyethylene (low density)	0.00091 to 0.00094
Polyethylene (high density)	0.00094 à 0.00096

(Source: https://www.globalplasticsheeting.com/our-blog-resource-library/bid/72325/Density-of-Polyethylene).

The following table presents test cases to be used for testing your program. Note that intermediate values for w_n are provided to allow you to trace your program to debug any problems.

Description	# (n)	Density d (kg/cm^3)	Thick. x (cm)	Ext. Dia. d_2 (cm)	Dia. hole d_1 (cm)	$d_2^2 - d_1^2$	$nxd\pi(d_2^2 - d_1^2)$	Weight w_n (kg)
Aluminum (M2)	1	0.0026	0.03	0.5	0.23	0.1971	4.83E-05	1.21E-05
Aluminum (M160)	1	0.0026	1.8	24.9	16.5	347.76	5.112995	1.28E+00
Acier (M12)	125	0.0076	0.25	2.35	1.3	3.8325	2.859537	7.15E-01
Acier (M24)	525	0.0076	0.39	4.4	2.5	13.11	64.08997	1.60E+01
Plastique (M20)	1530	0.00094	0.29	3.7	2.1	9.28	12.15948	3.04E+00
Bronze (M3)	750	0.0089	0.056	0.69	0.033	0.4750	047..557818	1.39E-01


```
"D:\UNIVERSITY\GNG 1106\Assignment 2 weigth of washers\bin\Debug\Assignment 2 weigth of washers.exe"
Please enter the number of washers:
125
Please enter the density of the washer's material, in kg/cm^3 :
.0076
Please enter the thickness of the washer, in centimeters (cm) :
.25
Please enter the external diameter, d2, of the washer in cm :
2.35
Please enter the diameter of the hole, d1, of the washer in cm :
1.3
The washer characteristics are:
Density: 0.00760 kg/cm^3
Thickness: 0.250 cm
External diameter: 2.350 cm
Diameter of the hole: 1.300 cm
The weight of 125 washers is 7.15E-001 kg
Process returned 0 (0x0)   execution time : 11.267 s
Press any key to continue.
```



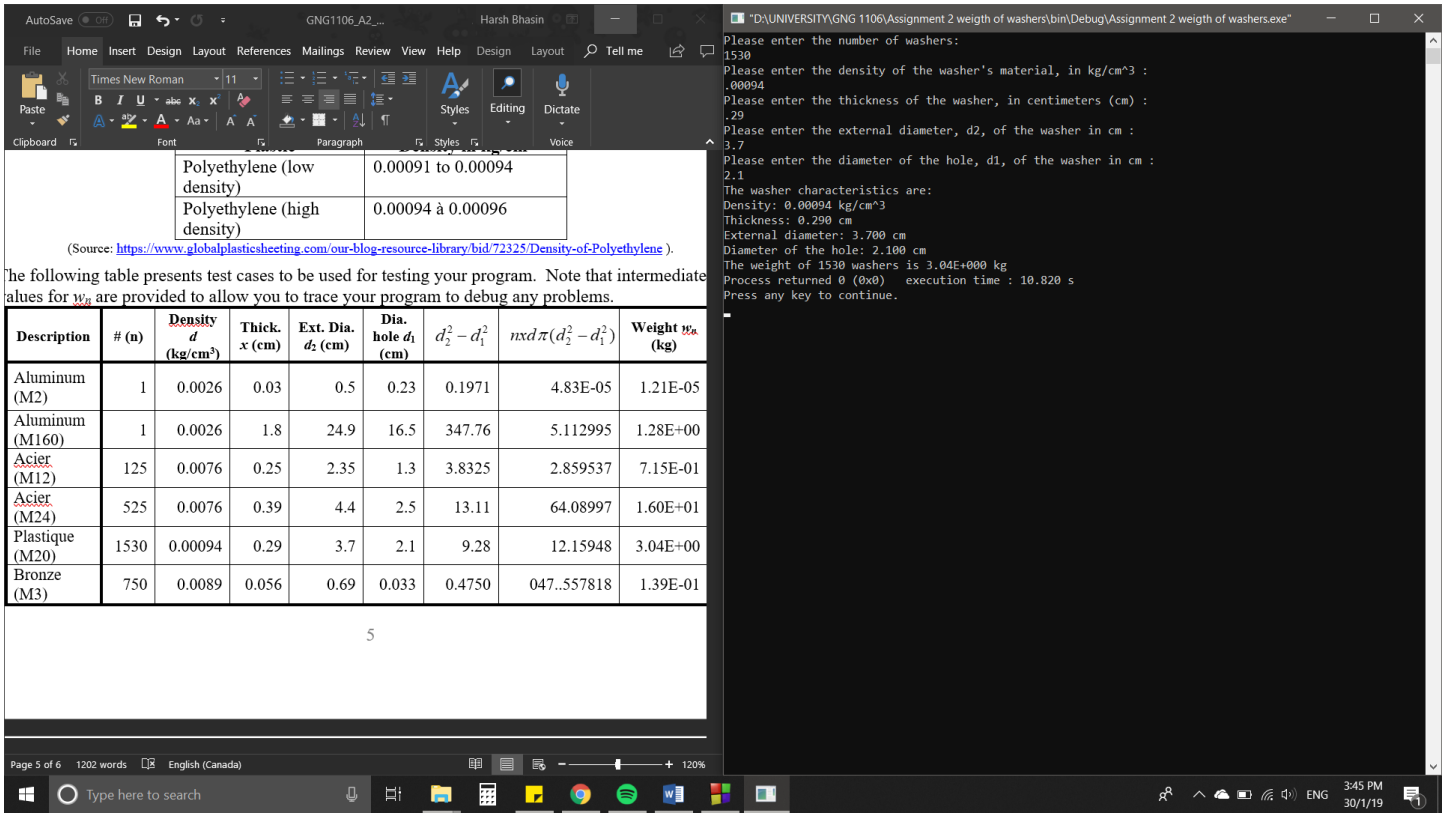
Polyethylene (low density)	0.00091 to 0.00094
Polyethylene (high density)	0.00094 à 0.00096

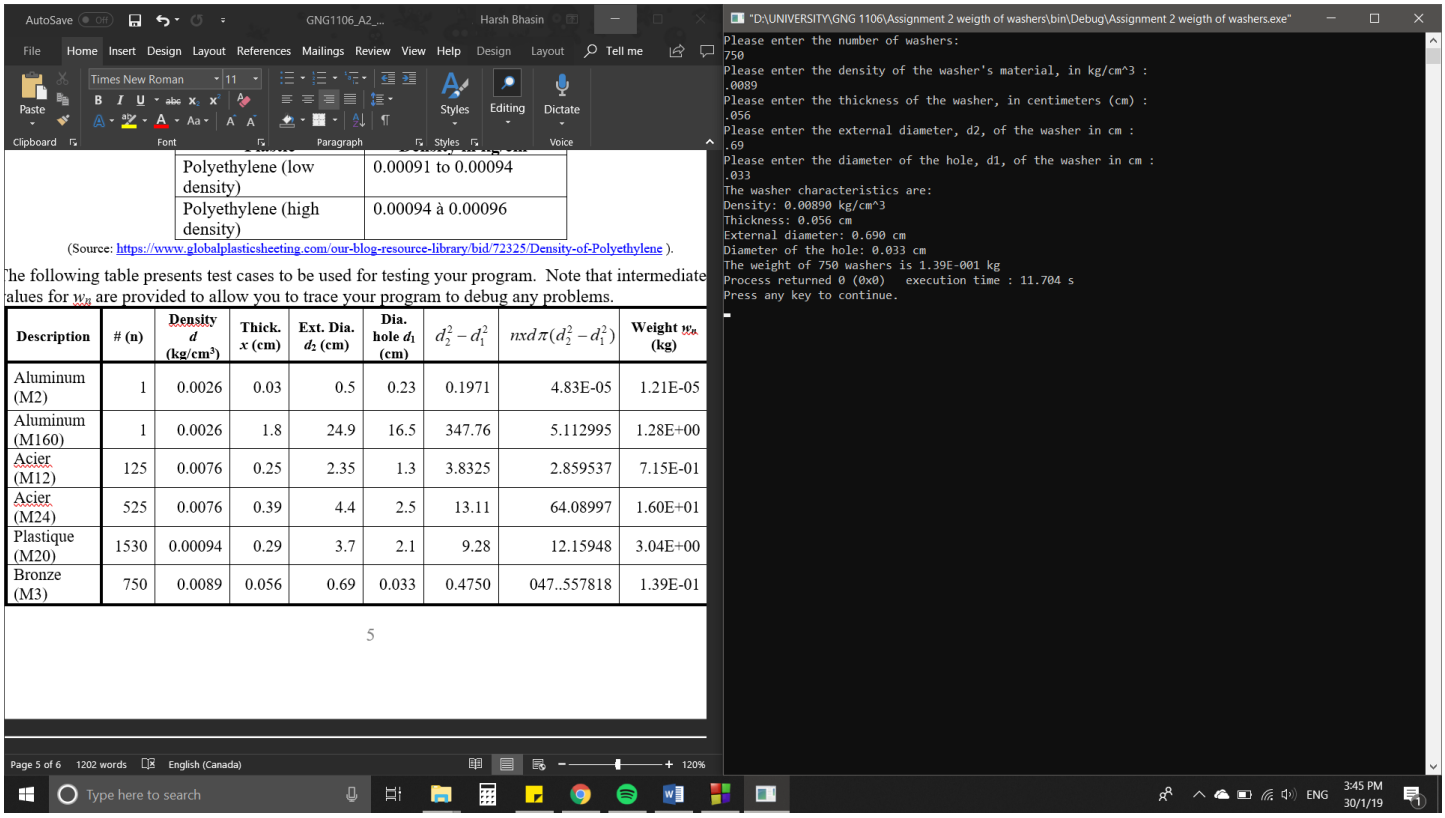
(Source: https://www.globalplasticsheeting.com/our-blog-resource-library/bid/72325/Density-of-Polyethylene).

The following table presents test cases to be used for testing your program. Note that intermediate values for w_n are provided to allow you to trace your program to debug any problems.

Description	# (n)	Density d (kg/cm^3)	Thick. x (cm)	Ext. Dia. d_2 (cm)	Dia. hole d_1 (cm)	$d_2^2 - d_1^2$	$nxd\pi(d_2^2 - d_1^2)$	Weight w_n (kg)
Aluminum (M2)	1	0.0026	0.03	0.5	0.23	0.1971	4.83E-05	1.21E-05
Aluminum (M160)	1	0.0026	1.8	24.9	16.5	347.76	5.112995	1.28E+00
Acier (M12)	125	0.0076	0.25	2.35	1.3	3.8325	2.859537	7.15E-01
Acier (M24)	525	0.0076	0.39	4.4	2.5	13.11	64.08997	1.60E+01
Plastique (M20)	1530	0.00094	0.29	3.7	2.1	9.28	12.15948	3.04E+00
Bronze (M3)	750	0.0089	0.056	0.69	0.033	0.4750	047..557818	1.39E-01


```
"D:\UNIVERSITY\GNG 1106\Assignment 2 weigth of washers\bin\Debug\Assignment 2 weigth of washers.exe"
Please enter the number of washers:
525
Please enter the density of the washer's material, in kg/cm^3 :
0.0076
Please enter the thickness of the washer, in centimeters (cm) :
0.39
Please enter the external diameter, d2, of the washer in cm :
4.4
Please enter the diameter of the hole, d1, of the washer in cm :
2.5
The washer characteristics are:
Density: 0.00760 kg/cm^3
Thickness: 0.390 cm
External diameter: 4.400 cm
Diameter of the hole: 2.500 cm
The weight of 525 washers is 1.60E+001 kg
Process returned 0 (0x0)   execution time : 16.571 s
Press any key to continue.
```


AutoSave
GNG1106_A2_...
Harsh Bhasin
File Home Insert Design Layout References Mailings Review View Help Design Layout Tell me
Paste
Times New Roman
11
Styles
Editing
Dictate
Clipboard
Font
Paragraph
Styles
Voice
Polyethylene (low density) 0.00091 to 0.00094
Polyethylene (high density) 0.00094 à 0.00096
(Source: https://www.globalplasticsheeting.com/our-blog-resource-library/bid/72325/Density-of-Polyethylene).
he following table presents test cases to be used for testing your program. Note that intermediate
alues for w_n are provided to allow you to trace your program to debug any problems.
Description | # (n) | Density d (kg/cm3) | Thick. x (cm) | Ext. Dia. d2 (cm) | Dia. hole d1 (cm) | $d_2^2 - d_1^2$ | $nxd\pi(d_2^2 - d_1^2)$ | Weight w_n (kg)
Aluminum (M2) 1 0.0026 0.03 0.5 0.23 0.1971 4.83E-05 1.21E-05
Aluminum (M160) 1 0.0026 1.8 24.9 16.5 347.76 5.112995 1.28E+00
Acier (M12) 125 0.0076 0.25 2.35 1.3 3.8325 2.859537 7.15E-01
Acier (M24) 525 0.0076 0.39 4.4 2.5 13.11 64.08997 1.60E+01
Plastique (M20) 1530 0.00094 0.29 3.7 2.1 9.28 12.15948 3.04E+00
Bronze (M3) 750 0.0089 0.056 0.69 0.033 0.4750 047..557818 1.39E-01
5
Page 5 of 6 1202 words English (Canada) 120%
"D:\UNIVERSITY\GNG 1106\Assignment 2 weigth of washers\bin\Debug\Assignment 2 weigth of washers.exe"
Please enter the number of washers:
1530
Please enter the density of the washer's material, in kg/cm^3 :
.00094
Please enter the thickness of the washer, in centimeters (cm) :
.29
Please enter the external diameter, d2, of the washer in cm :
3.7
Please enter the diameter of the hole, d1, of the washer in cm :
2.1
The washer characteristics are:
Density: 0.00094 kg/cm^3
Thickness: 0.290 cm
External diameter: 3.700 cm
Diameter of the hole: 2.100 cm
The weight of 1530 washers is 3.04E+000 kg
Process returned 0 (0x0) execution time : 10.820 s
Press any key to continue.
Type here to search
ENG
3:45 PM
30/1/19



Polyethylene (low density)	0.00091 to 0.00094
Polyethylene (high density)	0.00094 à 0.00096

(Source: https://www.globalplasticsheeting.com/our-blog-resource-library/bid/72325/Density-of-Polyethylene).

The following table presents test cases to be used for testing your program. Note that intermediate values for w_n are provided to allow you to trace your program to debug any problems.

Description	# (n)	Density d (kg/cm^3)	Thick. x (cm)	Ext. Dia. d_2 (cm)	Dia. hole d_1 (cm)	$d_2^2 - d_1^2$	$nxd\pi(d_2^2 - d_1^2)$	Weight w_n (kg)
Aluminum (M2)	1	0.0026	0.03	0.5	0.23	0.1971	4.83E-05	1.21E-05
Aluminum (M160)	1	0.0026	1.8	24.9	16.5	347.76	5.112995	1.28E+00
Acier (M12)	125	0.0076	0.25	2.35	1.3	3.8325	2.859537	7.15E-01
Acier (M24)	525	0.0076	0.39	4.4	2.5	13.11	64.08997	1.60E+01
Plastique (M20)	1530	0.00094	0.29	3.7	2.1	9.28	12.15948	3.04E+00
Bronze (M3)	750	0.0089	0.056	0.69	0.033	0.4750	047..557818	1.39E-01


```
"D:\UNIVERSITY\GNG 1106\Assignment 2 weigth of washers\bin\Debug\Assignment 2 weigth of washers.exe"
Please enter the number of washers:
750
Please enter the density of the washer's material, in kg/cm^3 :
.0089
Please enter the thickness of the washer, in centimeters (cm) :
.056
Please enter the external diameter, d2, of the washer in cm :
.69
Please enter the diameter of the hole, d1, of the washer in cm :
.033
The washer characteristics are:
Density: 0.00890 kg/cm^3
Thickness: 0.056 cm
External diameter: 0.690 cm
Diameter of the hole: 0.033 cm
The weight of 750 washers is 1.39E-001 kg
Process returned 0 (0x0)   execution time : 11.704 s
Press any key to continue.
```