EGR 125 Name: \_David Vermaak\_\_\_\_\_\_\_\_\_\_\_

Introduction to Engineering Methods (C++) Due Date: \_\_9/2/2021\_\_\_\_\_\_\_\_\_\_\_\_\_

File: N125-Ch2LB rev1

**Chapter 2 Homework**

**Reading Assignment:4.5**

Read Chapter 1-2 in Introduction to Programming with C++, 3rd Edition, by Liang

**Problem Assignment:**

Submit each of the following by the assigned due date.

1. (30 pts) Work the following problems in the textbook. Work each problem by hand (not by using the compiler). Be sure to write out the instructions for each problem and include the given information. Work all parts for each problem unless otherwise noted.

Checkpoint Exercises

**2.4**: Which of the following identifiers are valid? Which are C++ keywords?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| miles | Test | a++ | --a | 4#R | $4 | #44 |
| *Valid* | *Valid* | Invalid | Invalid | Invalid | Invalid | Invalid |
|  |  | (adds 1 to a) | (subtracts 1 from a) | (starts with 4) | (starts with $) | (starts with #) |
| apps | main | double | int | x | y | radius |
| *Valid* | *Valid* | Invalid | Invalid | *Valid* | *Valid* | *Valid* |
|  |  | Keyword | Keyword |  |  |  |

**2.11**: Which of the following are the same as 52.534?

5.2534e+1, 0.52534e+2, 525.34e-1, 5.2534e+0 (all except the last one)

**2.12**: Show the result of the following remainders:

56 % 6 = ***2*** 78 % 4 = ***2*** 34 % 5 = ***4***

34 % 15 = ***4*** 5 % 1 = ***0*** 1 % 5 = ***1***

**2.13**: If today is Tuesday, what day will it be in 100 days?

*100 / 7 roughly = 14 and 7\*14 = 98 thus +2 and Tue + 2 is* ***Thursday***

2.15: Show the result of the following code:

cout << 2 \* (5 / 2 + 5 / 2) << endl; | ***8 // order of operations: (), \*, /, +, -***

cout << 2 \* 5 / 2 + 2 \* 5 / 2 << endl; | ***10***

cout << 2 \* (5 / 2) << endl; | ***4***

cout << 2 \* 5 / 2 << endl; | ***5***

**2.23**: Show the printout of the following code:

int a = 6;

int b = a++;

cout << a << endl; | ***7 //a is added to, after b gets its value thus a=a+1 which is 7***

cout << b << endl; | ***6 //and b=a which is 6 as the addition happened after.***

a = 6;

b = ++a;

cout << a << endl; | ***7 //a is added to and then b equals its value thus a=a+1 which is 7***

cout << b << endl; | ***7***

**2.24**: Show the printout of the following code:

int a = 6;

int b = a--;

cout << a << endl; | ***5 // a is subtracted from, after b gets its value thus a=a-1 which is 5***

cout << b << endl; | ***6 //and b=a which is 6 as the subtraction happened after.***

a = 6;

b = --a;

cout << a << endl; | ***5 //a is subtracted from and then b equals its value thus a=a-1 which is 5***

cout << b << endl; | ***5***

2) (30 pts) Fill in the answers in the boxes provided on the following worksheet. Do this by hand (not by using the compiler). Turn in the worksheet along with parts 1 and 3 to this assignment.

2A) For the following exercises determine if each is a valid string literal. If it is not, give a reason.

|  |  |  |
| --- | --- | --- |
| Problem | Valid? (Y / N*)* | If not valid, why? |
| 1. ’Yes’ | N | It needs to have “ “ marks around it |
| 2. "1\_\_1" | Y |  |
| 3. "\"quotation\"" | Y |  |
| 4 "3+4=5" | Y |  |
| 5 "c:\\EGR125\\Files\\" | Y |  |
| 6. $2.50 | N | It needs to have “ “ marks around it |
| 7. \"Compile"\ | N | It needs to have “ “ marks around it |
| 8. "Say \"Hello\" | Y |  |

2B) For the following exercises find the value of integer A after executing the instructions shown.

|  |  |
| --- | --- |
| Problem | Result |
| 9. A = 8;  A += 3; | ***A is 11*** |
| 10. A = 14;  A /= 3; | ***A is 4*** |
| 11. A = 14;  A %= 3; | ***A is 2*** |
| 12. A = 5;  A++; | ***A is 6*** |
| 13. B = 5;  A = B--; | ***A is 5*** |
| 14. B = 5;  A = --B; | ***A is 4*** |
| 15. A = 7+4\*6-2 | ***A is 29*** |
| 16. A = (7+4)\*6-2 | ***A is 64*** |
| 17. A = 7+4\*(6-2) | ***A is 23*** |
| 18. A = (7+4)\*(6-2) | ***A is 44*** |
| 19. A = 4E6/25E-2 | ***A is 1.6E7*** |

2C) Write C++ expressions to compute each of the following quantities (it is not necessary to declare each variable).

|  |  |
| --- | --- |
| Problem | ***C++ expression*** |
| 20. H equals the square root of A2+ B*2* | ***H = sqrt(pow(A, 2) + pow( B, 2));*** |
| 21. Area = ½(Base)(Height) | ***Area = 0.5 \* Base \* Height;*** |
| 22. | ***V = 6.5 \*( exp(-25\*t)) \* (cos(2\*(acos(-1.0)\*t));*** |
| 23. Electron charge = -1.6022 x 10-19 (use scientific notation, not an exponent) | ***EC = -1.6022e-19;*** |
| 24. y = 3cos[tan-1(α)] | ***Y = 3\*cos(atan(a));*** |
| 25. y = log10(210) | ***Y = log10(pow(2, 10));*** |
| 26. | ***Y = (10\*exp(-12))/(abs(a + b));*** |
| 27. | ***Y = 4\*pow((cos(2\* acos(-1.0))/3)), 2);*** |
| 28. | ***Y = asin(4\*x + log(2));*** |
| 29. | ***Y = pow((2/3), (n + 1));*** |
| 30. | ***Y =pow( (log(45)), (1/3));*** |

3) (40 pts) Write C++ programs for each of the following. Use a C++ editor, compile, then run.

For each program:

* Use the TCC template (see next page). Complete the items listed in the template.
* Include plenty of comments.
* The output should be neatly and clearly formatted.
* Use good programming style and proper indentation.
* Turn in a printout of the program and printouts for all required test cases.

1. Write a program for ***Programming Exercise 2.20 (slope of a line)*** on p. 69 in the textbook.

Prompt for the x,y coordinates of two endpoints of a line segment, then compute and report the slope of this line. Recall, the slope (m) = (y2-y1)/(x2-x1). No protection from division by zero is required (that would need some chapter 3 skills we have not yet discussed in class).

* Testing: Run the program for the three cases shown below (the first case is the example provided with the problem in the text).
* Display the result in the format indicated in the textbook problem.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Case | x1 | y1 | x2 | y2 |
| 1 | 4.5 | -5.5 | 6.6 | -6.5 |
| 2 | -1.5 | 2.5 | 4.5 | -7.5 |
| 3 | Pick any example with (x1,y1) in the 2nd quadrant and (x2,y2) in the 4th quadrant | | | |

B) Write a program for ***Programming Exercise 2.7 (convert minutes to years and days)*** on p. 66 in the textbook.

* Testing: Run the program for the three cases shown below
* Display the result in the format indicated in the textbook problem.

|  |  |
| --- | --- |
| Case | Number of Minutes |
| 1 | 1000000000 |
| 2 | Any 4 digit number |
| 3 | Any 6 digit number |

C) Write a program to calculate the remaining one side and two angles for a triangle given two sides and one opposite angle using the ***law of sines***, as illustrated below. Units are not required for the sides.

* Use the TCC template
* Inputs: sides a, b, and angle A (in degrees)
* Outputs: angles B and C and side c (add the word ***degrees*** after each angle)
* Turn in a printout of the program and printouts for all required test cases.
* Testing: Run the program for the three cases shown below (answers shown for Case 1 in example below):

|  |  |  |  |
| --- | --- | --- | --- |
| Case | a | b | A |
| 1 | 20 | 10 | 30° |
| 2 | 7.5 | 10.5 | 40° |
| 3 | 100 | 100 | 60° |



A

a

C

b

c

## B

**PROGRAM A**

// \_\_\_\_ \_\_ \_\_

// / / \ / \

// / / /

// / \\_\_\_/ \\_\_\_/

//

// Date: 9/1/2021

// Name: David Vermaak

// Project Description: Slope of a line

// Inputs: the co-ordinates of two points (x1, y1) (x2, y2)

// Outputs: The slope of the line between the two points

//\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#include <iostream> //header containing cout and cin

#include <string>

using namespace std; //introduces namespace std

int main ( )

{

double x1, x2, y1, y2, slope; // initalizes the variables we will use to store values

cout << "Please enter the first x value,\n x1 = \n"; //asks for the first x value

cin >> x1; //takes the users input and stores it to x1

cout << "Please enter the first y value,\n y1 = \n"; //asks for the first y value

cin >> y1; //takes the users input and stores it to y1

cout << "Please enter the second x value,\n x2 = \n"; //asks for the second x value

cin >> x2; //takes the users input and stores it to x2

cout << "Please enter the second y value,\n y2 = \n"; //asks for the second y value

cin >> y2; //takes the users input and stores it to y2

slope = (y2 - y1)/(x2 - x1);

cout << "The slope of the line is " << slope;

return 0;

}

**OUTPUT A1:**

Please enter the first x value,

x1 = 4.5

Please enter the first y value,

y1 = -5.5

Please enter the second x value,

x2 = 6.6

Please enter the second y value,

y2 = -6.5

The slope of the line is -0.47619

--------------------------------

Process exited after 74.07 seconds with return value 0

**OUTPUT A2:**

Please enter the first x value,

x1 = -1.5

Please enter the first y value,

y1 = 2.5

Please enter the second x value,

x2 = 4.5

Please enter the second y value,

y2 = -7.5

The slope of the line is -1.66667

--------------------------------

Process exited after 168 seconds with return value 0

**OUTPUT A3:**

Please enter the first x value,

x1 = -3.5

Please enter the first y value,

y1 = 4

Please enter the second x value,

x2 = 1.8

Please enter the second y value,

y2 = -1

The slope of the line is -0.943396

--------------------------------

Process exited after 21.43 seconds with return value 0

**PROGRAM B**

// \_\_\_\_ \_\_ \_\_

// / / \ / \

// / / /

// / \\_\_\_/ \\_\_\_/

//

// Date: 9/1/2021

// Name: David Vermaak

// Project Description: converts the minutes into years and days

// Inputs: a value of minutes

// Outputs: a value of years and a value of days

//\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#include <iostream> //header containing cout and cin

#include <string>

using namespace std; //introduces namespace std

int main ( )

{

int days; // initalizes the variables we will use to store integer values

double minutes, years; // initalizes the variables we will use to store decimal values

cout << "Please enter the number of minutes,\n m = "; //asks for the value in minutes

cin >> minutes; //gets the users input in minutes

days = minutes / (60\*24); //calculates the days from minutes

years = days / 365; //calculates the years from days

days = days % 365; //calculates the remaining days after years

cout << "there are " << years << " years and " << days << " days in " << minutes << " minutes";

return 0;

}

**OUTPUT B1:**

Please enter the number of minutes,

m = 1000000000

there are 1902 years and 214 days in 1e+009 minutes

--------------------------------

Process exited after 3.959 seconds with return value 0

**OUTPUT B2:**

Please enter the number of minutes,

m = 9999

there are 0 years and 6 days in 9999 minutes

--------------------------------

Process exited after 3.571 seconds with return value 0

**OUTPUT B3:**

Please enter the number of minutes,

m = 987654

there are 1 years and 320 days in 987654 minutes

--------------------------------

Process exited after 14.29 seconds with return value 0

***Good day Professor, I got a bit carried away on this last one. Enjoy!***

**PROGRAM C**

// \_\_\_\_ \_\_ \_\_

// / / \ / \

// / / /

// / \\_\_\_/ \\_\_\_/

//

// Date: 9/1/2021

// Name: David Vermaak

// Project Description: Law of sines calculator

// Inputs: angles and sides of triangles

// Outputs: angles and sides of triangles

//\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#include <iostream> //This header containing cout and cin

#include <string>

#include <conio.h> //This header declares getch which pauses until a key is pushed

#include <math.h> //This header allows for the use of more complex mathematical operators

using namespace std; //introduces namespace std

int main ( )

{

int choice; //initializes a variable for the menu

do //created a loop using do and while (see below)

{

// display menu

cout << "Please choose one of the following options to continue:\n\n";

cout << "Two sides and an angle (1) \n";

cout << "Two angles and a side (2) \n";

cout << "Quit with any other number \n\n";

cout << "Enter your choice :\n";

//get user input

cin >> choice;

cout << "\n";

double a, b, c, angle\_A, angle\_B, angle\_C; // initializes the variables

const float pi = 3.14159265; // sets up a constant

switch(choice) //easy way to set up a menu where it jumps to the correct line

{

case 1:

cout << "You have selected Two sides and an angle, also known as a SSA triangle\n";

cout << "Please input the first side\n";

cin >> a;

cout << "Please input the second side\n";

cin >> b;

cout << "Please input the angle in degrees\n";

cin >> angle\_A;

angle\_A = angle\_A \* (pi / 180); //degrees to radians

angle\_B = asin((b\*sin(angle\_A))/a); //calculates the angle by law of sines

angle\_C = (pi)-(angle\_A + angle\_B); //pi = number of radians in a triangle

c = (sin(angle\_C)\*a)/sin(angle\_A); //calculates the side by law of sines

angle\_B = angle\_B \* ( 180/ pi); //radians to degrees

angle\_C = angle\_C \* ( 180/ pi);

cout << "The two angles are B = " << angle\_B << " and C = " << angle\_C; //output

cout << " The side c is " << c;

getch(); //pauses until a key is pressed

system("cls"); //clears the console screen

break;

case 2:

cout << "You have selected Two angles and a side, also known as a AAS triangle\n";

cout << "Please input the first angle in degrees\n";

cin >> angle\_A;

cout << "Please input the second angle in degrees\n";

cin >> angle\_B;

cout << "Please input the side\n";

cin >> a;

angle\_A = angle\_A \* (pi / 180); //degrees to radians

angle\_B = angle\_B \* (pi / 180); //degrees to radians

angle\_C = (pi)-(angle\_A + angle\_B); //pi = number of radians in a triangle

b = (sin(angle\_B)\*a)/sin(angle\_A); //calculates the side b by law of sines

c = (sin(angle\_C)\*a)/sin(angle\_A); //calculates the side c by law of sines

angle\_C = angle\_C \* ( 180/ pi); //radians to degrees

cout << "The two sides are b = " << b << " and c = " << c; //output

cout << " The angle C is " << angle\_C;

getch();

system("cls");

break;

default: //catch-all case for numbers not used

cout << "Program has ended\n";

return 0;

}

}

while(choice != 1 || 2); //keeps the loop going while conditions are right

return 0;

}

**OUTPUT C1:**

Please choose one of the following options to continue:

Two sides and an angle (1)

Two angles and a side (2)

Quit with any other number

Enter your choice :

1

You have selected Two sides and an angle, also known as a SSA triangle

Please input the first side

20

Please input the second side

10

Please input the angle in degrees

30

The two angles are B = 14.4775 and C = 135.522 The side c is 28.0252

**OUTPUT C2:**

Please choose one of the following options to continue:

Two sides and an angle (1)

Two angles and a side (2)

Quit with any other number

Enter your choice :

1

You have selected Two sides and an angle, also known as a SSA triangle

Please input the first side

7.5

Please input the second side

10.5

Please input the angle in degrees

40

The two angles are B = 64.1453 and C = 75.8547 The side c is 11.3141

**OUTPUT C3:**

Please choose one of the following options to continue:

Two sides and an angle (1)

Two angles and a side (2)

Quit with any other number

Enter your choice :

1

You have selected Two sides and an angle, also known as a SSA triangle

Please input the first side

100

Please input the second side

100

Please input the angle in degrees

60

The two angles are B = 60 and C = 60 The side c is 100

Please choose one of the following options to continue:

Two sides and an angle (1)

Two angles and a side (2)

Quit with any other number

Enter your choice :

3

Program has ended

--------------------------------

Process exited after 235.4 seconds with return value 0

***Note:***

*I did extra work on the last program just to see if I could get a menu working.*

*If you want to see my various other attempts they will be included below*

// \_\_\_\_ \_\_ \_\_

// / / \ / \

// / / /

// / \\_\_\_/ \\_\_\_/

//

*// Date: 9/1/2021*

*// Name: David Vermaak*

*// Project Description: A Better Menu Template*

*// Inputs:*

*// Outputs:*

*//\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*#include <iostream> //header containing cout and cin*

*#include <string>*

*#include <conio.h> //This header declares getch which pauses until a key is pushed*

*using namespace std; //introduces namespace std*

*int main ( )*

*{*

*int choice;*

*do*

*{*

*// display menu*

*cout << "Please choose one of the following options to continue:\n\n";*

*cout << "Option 1: (A) \n";*

*cout << "Option 2: (B) \n";*

*cout << "Option 3: (C) \n";*

*cout << "Option 4: Quit\n\n";*

*cout << "Enter your choice (1-4):\n";*

*//get user input*

*cin >> choice;*

*cout << "\n";*

*switch(choice)*

*{*

*case 1:*

*cout << "You have selected option A\n";*

*//place the operations and calculations here*

*getch();*

*system("cls");*

*break;*

*case 2:*

*cout << "You have selected option B\n"; //place the operations and calculations here*

*getch();*

*system("cls");*

*break;*

*case 3:*

*cout << "You have selected option C\n"; //place the operations and calculations here*

*getch();*

*system("cls");*

*break;*

*case 4:*

*cout << "Program has ended\n";*

*getch();*

*return 0;*

*default:*

*cout << "Invalid Selection. Try Again\n";*

*cout << "The options only include (1,2,3,4)\n";*

*cout << "How hard can this be?\n";*

*}*

*}*

*while(choice != 4);*

*return 0;*

*}*

// \_\_\_\_ \_\_ \_\_

// / / \ / \

// / / /

// / \\_\_\_/ \\_\_\_/

//

*// Date: 9/1/2021*

*// Name: David Vermaak*

*// Project Description: Template Of a menu*

*// Inputs:*

*// Outputs:*

*//\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*#include <iostream>*

*using namespace std;*

*int main ()*

*{*

*int choice, A, B, C, a, b, c;*

*cout << "Please choose one of the following options to continue:\n\n";*

*cout << "Option 1: A \n";*

*cout << "Option 2: B \n";*

*cout << "Option 3: C \n";*

*cout << "Option 4: Quit\n\n";*

*cout << "Enter your choice (1-4):";*

*cin >> choice;*

*cout << "\n";*

*if (choice == 1)*

*//Perform calculation A;*

*{cout << "Input A: ";*

*cin >> A;*

*cout << endl;*

*int a = A \* A;*

*cout << "The answer of A is: " << a << endl;*

*}*

*else if (choice == 2)*

*//Perform calculation B;*

*{cout << "Input B: ";*

*cin >> B;*

*cout << endl;*

*int b = B \* B;*

*cout << "The answer of B is: " << b << endl;*

*}*

*else if (choice == 3)*

*//Perform calculation C;*

*{cout << "Input C: ";*

*cin >> A;*

*cout << endl;*

*int c = C \* C;*

*cout << "The answer of C is: " << c << endl;*

*}*

*else if (choice == 4)*

*//quit*

*cout << "Goodbye. \n";*

*else if ((choice <1) || (choice >= 4))*

*cout << "Error.\n";*

*return 0;*

*}*