Exercises with solutions

https://csci-1301.github.io/about#authors

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Contents

1 Homework #1
   1.1 Part I — Questions .................................................. 1
   1.2 Part II — Problems .................................................. 5

2 Homework #2
   2.1 Part I — Questions .................................................. 6
   2.2 Part II — Problems .................................................. 9

3 Homework #3
   3.1 Part I — Questions .................................................. 11
   3.2 Part II — Problems .................................................. 19

4 Homework #4
   4.1 Part I — Questions .................................................. 20
   4.2 Part II — Problems .................................................. 28

5 Homework #5
   5.1 Part I — Questions .................................................. 30
   5.2 Part II — Problems .................................................. 34

6 Homework #6
   6.1 Part I — Questions .................................................. 35

7 Quizzes
   7.1 Quiz 1 ..................................................................... 39
   7.2 Quiz 2 ..................................................................... 40
   7.3 Quiz 3 ..................................................................... 41

1 Homework #1

1.1 Part I — Questions

1. List five pieces of software, and three hardware components of a computer.

Solution

Accept operating system as a software, cellphone is not a component of a computer.
2. List four programming languages.

   Solution
   C, C++, C#, Java, JavaScript, Python, Haskell, Swift, RWBY, etc (Note: HTML is a “Markup Language” and SQL is a “Query Language”, which would technically be incorrect)

3. What is a GUI?

   Solution
   Graphical User Interface.

4. What is a CLI?

   Solution
   Command-Line Interface.

5. What, if any, is the difference between a compiler and an assembler?

   Solution
   The compiler goes from High-level language to Machine language, the assembler goes from Assembly language to Machine language.

6. Is machine code (or the machine language program) is made of circuits, binary numbers, classes, or compilers?

   Solution
   Binary numbers.

7. Give a specific characteristic of C# compared to other programming languages.

   Solution
   It’s a compiled language, it has automatic garbage collection, it’s object-oriented, it enforces .NET common language specification, etc.

8. What happens when the source code you are giving to the compiler has a syntax error?

   Solution
   The compiler returns an error and fails to compile your code.

9. Is the C# compiler case-sensitive?

   Solution
   Yes, the C# compiler is case-sensitive (meaning that the IDE differentiates between capital and lowercase letters).

10. Suppose I replace every white space in your source code with two white spaces. Will your program still compile? Why, or why not?

    Solution
    Yes, because compilers do not care about white spaces.

11. Give three keywords.

    Solution
    You can consult the “official” list of keywords as https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/keywords/. Are valid answers: int, using, static, public, etc. Note that main or System are not keywords.
12. Write a statement that would display, “Hi Mom!” (without the quotes) followed by a new line on the screen, once inserted in a proper method, compiled, and executed.
   Solution
   Console.WriteLine("Hi Mom!");

13. Write a statement that would display, “Hello!” (without the quotes) followed by a new line on the screen, once inserted in a proper method, compiled, and executed.
   Solution
   Console.WriteLine("Hello!");

14. What is the limitation, if any, to the number of methods you can have per class? Why is the method called Main special?
   Solution
   A class usually has one or more methods. No limitation, really. It is special because it is the first one to be executed, it is the entry point.

15. What is the difference between a “rule” and a “convention” in programming language?
   Solution
   A rule is required by the programming language and enforced by the compiler. A convention is only a recommendation to make your program easier for other humans to read; you can break it and your code will still work.

16. What is a namespace?
   Solution
   A named collection of related library code.

17. In a C# program, can comments start with \ (double backslash) or with // (double (forward) slash)? Do they have to end with a ; (semicolon)?
   Solution
   With //, no.

18. Which of the following, if any, are keywords? Welcome1 public apples int "I’m a string"
   Solution
   public, int

19. Which of the following are programmer-defined names (or identifiers)? BankAccount class apples int itemPerCapita statement.
   Solution
   BankAccount, apples, itemPerCapita, statement.

20. Why are variables called “variables”?
   Solution
   Because their value may change during the program’s execution.

21. What is string interpolation?
   Solution
   The action of inserting a variable into a string that is displayed at the screen.
22. What is the difference, if any, between 12, and "12"?
   Solution
   The first one is an integer, the second is a string.

23. What is the difference, if any, between the `WriteLine` and `Write` methods?
   Solution
   The `Write` method does not advance the cursor to the next line after the message is displayed at the screen.

24. Write a statement that would display the following on the screen: Hi Mom!
    How are you doing?
   Solution
   ```csharp
   Console.WriteLine("Hi Mom!\nHow are you doing?");
   ```

25. Assume we have a variable whose name is `myVariable`, type is `string`, and value is "My message". What would be displayed on the screen by the following statement? `Console.WriteLine("Here is my variable: {myVariable}");`
   Solution
   ```csharp
   Here is my variable: My message
   ```

26. Assume we have a variable whose name is `level`, whose type is `string`, and whose value is "Easy". What would be displayed at the screen by the following statement? `Console.WriteLine("You set the difficulty to {level}.")`
   Solution
   ```csharp
   You set the difficulty to Easy.
   ```

27. Which of the following are correct identifier names? $myHome3 class myVariable ANewHope _train _ThisIsAVariable statement
   Is the name `myVariable` the same as `myvariable`? If not, why?
   Solution
   `$myHome3` is correct, but not recommended, `ANewHope, _ThisIsAVariable, statement` are also correct (but, of course, this latter is weird). The names `myVariable` and `myvariable` are treated differently by C#, because it is case-sensitive.

28. Which of the following are correct identifier names? `myClass _Exo_1 Lab3-Exo1 MyClass2 My.Lab.Variable using Lab3_Part1`
   Solution
   Identifiers: `myClass, Lab3_Part1`

29. Which of the following are keywords?
    `myClass static Lab3-Exo1 "Hello World" using Lab3_Part1`
   Solution
   ```csharp
   Keywords: static, using
   ```

30. Which of the following are correct identifier names?
    `12_Dec_2019 Lab3-Exo1 MyClass2 My.Lab.Variable string My_Var`
   Solution
   ```csharp
   OK: MyClass2, My_Var Not OK: 12_Dec_2019, Lab3-Exo1, My.Lab.Variable, string
   ```
31. Which one(s) of the following, if any, is a correct assignment (assuming that variable, x and apples have been declared as int variables)?

\[
5 \rightarrow \text{variable; } x = 5; \text{apples} = 23 \quad x \leq 23; \text{variable} = 1,890;
\]

Solution

Only \( x = 5; \) is correct.

32. Write a statement that assigns the value 23 to a variable myAge of type int. You do not need to re-declare that variable.

Solution

\[
\text{myAge} = 23;
\]

33. Cross out the wrong answer in the following sentences, [like this (incorrect) | like this (correct)]:

- “If the code does not obey the [rules | conventions] of C#, then the compiler will complain.”
- “Every statement needs to end with [a forward slash | a semi-colon].”
- “C# is a [object-oriented | functional] programming language.”
- “A class is made up of [a body and a header | multiple using statements].”
- “An identifier can contain [only lower-case letters | letters and digits].”

Solution

- If the code does not obey the rules of C#, then the compiler will complain.
- Every statement needs to end with a semi-colon.
- C# is an object-oriented programming language.
- A class is made up of a body and a header.
- An identifier can contain letters and digits.

1.2 Part II – Problems

1. There are 4 errors in the following code that will prevent it from compiling. Can you spot them all?

```csharp
// My first attempt.
using System
class Wel
{
    static void Main();
    {
        Console.WriteLine("Welcome \n to the lab!");
    }
}
```

Solution

a) Missing ; after using System
b) superfluous ; after static void Main()
c) missing . between Console and WriteLine
d) missing closing } for class Wel
2 Homework #2

2.1 Part I — Questions

1. In C#, what is the “escape character”? Why is it useful?
   Solution
   \
   to print “special characters”, like new line, tabulation, quotations mark, etc.

2. Write a statement that initializes a variable named myHeightInMeters to your height in meters. What should be the datatype of myHeightInMeters?
   Solution
   float myHeightInMeters = 1.68f The datatype should be any floating-point datatype.

3. Suppose you replace every * in your program with the ! symbol. Are you completely sure that your program would still compile? Why or why not?
   Solution
   No, because /* will be transformed into /!.

4. Give the values of a and b after the following four instructions have been executed.
   ```
   int a, b;
   a = 2;
   b = a * 2 + 1;
   a -= 1;
   ```
   Solution
   a is 1, b is 5.

5. Give the values of a and b after the following four instructions have been executed.
   ```
   int a, b;
   a = 4;
   b = a * 3 + 1;
   a /= 2;
   ```
   Solution
   a is 2, b is 13.

6. Give the values of c and d after the following four instructions have been executed.
   ```
   int c = 3, d;
   d = 2 + c;
   c = d * 2;
   d += 2;
   ```
   Solution
   c is 10, d is 7.

7. Is there an error in the following code? Explain the error or give the value of b after the second statement is executed.
   ```
   float a = 3.7f;
   int b = (int)a;
   ```
8. Is there an error in the following code? Explain the error or give the value of b after the second statement is executed.

```csharp
decimal a = 1.6M;
int b = (int)a + a;
```

Solution
No error; 3

9. There is an error in the following code, at the second line. Explain the error, and how you could fix this second line using a cast operator, without changing the datatype of the b variable.

```csharp
decimal a = 2.5M;
int b = a / 2;
```

Solution
Error, the result type of the operation is a decimal, and cannot be stored in an int.

10. If one of the operator’s operands is of type float and the other is of type int, what will be the type of the result of the operation?

Solution
float

11. What is the return type of the operation 12.4 * 3?

Solution
double

12. Write an explicit conversion from a double variable myDoubleVar to an int variable called myIntVar. You do not need to re-declare those variables. Assuming myDoubleVar’s value is 5.89, what value would be stored in myIntVar?

Solution
```csharp
myIntVar = (int)myDoubleVar;`, the value stored in myIntVar would be 5.
```

13. Write a statement that performs an implicit conversion between two different numeric datatypes.

Solution
```csharp
float m = 3;
```

14. Assuming that myLastName and myFirstName are two string variables that have been initialized, write a statement that concatenates them with a space and a comma in-between, and assign the resulting string to a variable named fullName. For instance, if the value of myLastName is "Holberton and", and the value of myFirstName is "Betty", then the value of fullName after your operation should be "Holberton and, Betty".

Solution
```csharp
string fullName = myLastName + "", " + myFirstName;
```
15. In C#, what is the name of the method used to read input from the user?  

Solution  

`ReadLine()`.

16. What is wrong with the following code? Will the error(s) appear at compilation time or at execution time?  

```csharp
int age;
Console.WriteLine("Please enter your age:");
age = Console.ReadLine();
```

Solution  

Conversion of `string` to `int`. At compilation time.

17. Will those statements, if placed in a proper `Main` method, compile? Could this program crash at execution time? Justify your answer.  

```csharp
int myAge;
Console.WriteLine("Please enter your age:");
myAge = int.Parse(Console.ReadLine());
```

Solution  

The code will compile, but can crash at execution time if the end user inputs a non-integer value.

18. Write a series of statements that: a) Declare an `int` variable named `userAge`, b) Display on the screen a message asking the user to enter his or her age, c) Read the value entered by the user and store it in the `userAge` variable. You can add statement(s) performing intermediate steps if you want.  

Solution  

```csharp
int userAge;
Console.WriteLine("Please enter your age.");
userAge = int.Parse(Console.ReadLine());
```

Note: This is not the only solution, but the most optimal.

19. Write a series of statements that: a) Declare an `string` variable named `favoriteColor`; b) Display on the screen a message asking the user to enter his or her favorite color; c) Read the value entered by the user and store it in the `favoriteColor` variable. You can combine some of the statement(s) if you want, but do not display at the screen any information that was not explicitly asked.  

Solution  

```csharp
string favoriteColor;
Console.WriteLine("Please enter your favorite color.");
favoriteColor = Console.ReadLine();
```

Note: This is not the only solution, but the most optimal.
2.2 Part II – Problems

The following three exercises do not require a computer. Make sure you feel ready before starting them, try to do them with limited time and without notes, and, if you want, check your answer using your IDE.

1. This problem restates the content of the Order of Operations\(^1\) section of the lecture notes and ask you to answer various problems.

There are 5 different arithmetic operations available in C#:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Arithmetic Operator</th>
<th>Algebraic Expression</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition</td>
<td>+</td>
<td>( x + 7 )</td>
<td>myVar + 7</td>
</tr>
<tr>
<td>Subtraction</td>
<td>-</td>
<td>( x - 7 )</td>
<td>myVar - 7</td>
</tr>
<tr>
<td>Multiplication</td>
<td>*</td>
<td>( x \times 7 )</td>
<td>myVar * 7</td>
</tr>
<tr>
<td>Division</td>
<td>/</td>
<td>( x/7 ), or ( x \div 7 )</td>
<td>myVar / 7</td>
</tr>
<tr>
<td>Remainder (a.k.a. modulo)</td>
<td>%</td>
<td>( x \mod 7 )</td>
<td>myVar % 7</td>
</tr>
</tbody>
</table>

Computing operations involving one of them is straightforward:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 + 4</td>
<td>7</td>
</tr>
<tr>
<td>3 - 4</td>
<td>-1</td>
</tr>
<tr>
<td>3 * 4</td>
<td>12</td>
</tr>
<tr>
<td>6 / 2</td>
<td>3</td>
</tr>
<tr>
<td>6 % 4</td>
<td>2</td>
</tr>
</tbody>
</table>

But things can get complicated when multiple operators are used, but no parenthesis are indicated. For instance, should

\[ 7 / 2 - 4 * 8 \mod 3 \]

be read as

\[
(7 \div (2 - 4)) \times (8 \mod 3) = (7 \div (-2)) \times 2 = (-3.5) \times 2 = -7
\]

or as

\[
(7 \div (2 - 4)) \times (8 \mod 3) = 3.5 - (32 \mod 3) = 3.5 - 2 = 1.5
\]

Certainly, the result is not the same and there are other possible ways this calculation may be performed!

Actually, C# uses the following three rules:

a) *, /, and \%, called the “multiplicative operations,” are always evaluated before + and −, called the “additive operations.” So that, for instance,

\(^1\)https://csci-1301.github.io/book.html#order-of-operations
will be evaluated as $2 - (4 \times 8) = -30$.

b) If there are multiple operations of the same type, they are evaluated from left to right. For instance,

$\frac{4}{2} \times 8$

will be evaluated as $(4 \div 2) \times 8 = 16$ and

$4 - 2 + 8$

will be evaluated as $(4 - 2) + 8 = 10$.

c) Parenthesis can be used to force a particular order of evaluation, so that $2 \times (3 + 4)$ will be evaluated as $2 \times 7 = 14$, not as $(2 \times 3) + 4 = 6 + 4 = 10$ as it would without the parenthesis.

Answer the following:

a) Which of the following operation(s) compute the arithmetic expression $(x \times (3 \mod 5)) - (y \times 7)$?

i. $x \times 3 \% 5 - y \times 7$

ii. $x \times (3 \% 5) - y \times 7$

iii. $(x \times 3) \% 5 - y \times 7$

iv. $x \times 3 \% (5 - y \times 7)$

v. $(x \times 3 \% 5) - (y \times 7)$

vi. $(x \times ((3 \% 5) - (y \times 7)))$

b) State the order of evaluation of the operators in each of the following operations, and compute the resulting value:

i. $8 - 39 \times 1 / 12 + 5$

ii. $12 + 23 / 12 \% 3$

iii. $90 \times 23 / 34 - 12 - 13$

iv. $12 \% 83 - 2 \times 3$

c) (Optional) Check your answers using your IDE. You can use a statement of the form:

```
Console.WriteLine("8 - 39 * 1 / 12 + 5 is {8 - 39 * 1 / 12 + 5}");
```

2. Write down, on a piece of paper, a fully compilable program that initializes an int variable named persons with the value 5, an int variable named bottles with the value 3, and a double variable named literPerBottle with the value 1.5. What should be the type of the literPerPerson variable to be able to be assigned the number of liters every person is going to get, if split equitably? Write the correct initialization of that variable and a statement that displays its value.

Place a delimited comment with your name and the time at which you wrote the program at the top of the program.

3. Write down, on a piece of paper, a program that:

a) Declares a string variable named userName.

b) Displays on the screen “Please enter your name, followed by enter:”.

c) Reads a string value from the keyboard and assigns the value to the userName variable.

d) Declares an int variable named number.

e) Displays on the screen “Please enter your number:”.

f) Reads an int value from the keyboard and assigns the value to the number variable.

g) Declares a string variable named id and initializes it with the string referenced by the userName variable, followed by the number entered by the user (you can concatenate a string and an int using the + sign).


h) Displays on the screen, “Your id is” and the content of the id variable.

Here is an example of execution, where the user input is underlined, and hitting “enter” is represented by ↵:

Please enter your name, followed by enter.
Jaylah ↵
Please enter your area code, followed by enter.
49391 ↵
Your id is Jaylah49391
Press any key to continue . . .

3 Homework #3

3.1 Part I – Questions

1. What is “an instance of a class”?
   Solution
   An object.

2. Fill in the blanks: “A class asserts that every objects created using it should have_________________ (i.e., "data") and_________________ (i.e., “operations”).”
   Solution
   Attributes and methods.

3. Give two access modifiers.
   Solution
   public and private.

4. What, if any, is the difference between a parameter and an argument?
   Solution
   “Parameters” are called “formal parameters” and are used when defining the method, while “arguments” are called “actual parameters” and are used when calling the method. A method has parameters and takes arguments.

5. Write a statement that creates a new object from the Rectangle class.
   Solution
   Rectangle myRec = new Rectangle();

6. What is the purpose of the keyword new?
   Solution
   To create objects, to instantiate classes.

7. Do different objects from the same class share their instance variables?
   Solution
   No, there is one instance variable per object.
8. Briefly explain the difference between a local variable and an instance variable.

Solution

A local variable exists only within a single method; instance variables are available/accessible to all methods in a class.

9. Suppose we have a Circle class containing

```csharp
public void SetRadius(double radiusArgument)
{
    radius = radiusArgument;
}
```

Write a statement that create a Circle object, and one statement that sets its radius to 3.5.

Solution

```csharp
Circle theCircle = new Circle();
theCircle.SetRadius(3.5);
```

10. Indicate the order of evaluation of the operators in each of the following C# operations by adding parenthesis or developing the expression one step at a time, and compute the resulting value:

   a) 3 * 4 - 2
   b) 3 % 2 + 3
   c) 2 - 3 + 3 * 2
   d) 2 + 2 * 1 - 4

11. Write the complete implementation of a class that contains two attributes (with different data types), a setter for one attribute, a getter for the other attribute, a custom constructor, and a ToString method. You can re-use an example from a lecture or a lab, as long as it satisfies those conditions, or you can invent one. No need to write an application program.

Solution

Note: In this solution, the Rectangle class from the lab was used, but any class fulfilling the requirements will work.

```csharp
class Rectangle
{
    private int length;
    private int width;

    public Rectangle(int lengthP, int widthP)
    {
        length = lengthP;
        width = widthP;
    }
    public void SetLength(int lengthParameter)
    {
        length = lengthParameter;
    }
    public int GetWidth()
    {
        return width;
    }
    public override string ToString()
    {
        return "Rectangle with length \n```
12. What does the keyword `return` do?
   
   Solution
   
   It is used by a method to return a value to the environment that called it.

13. Write a get method for an instance variable named `total` of type `int`.
   
   Solution
   
   ```
   public int GetTotal()
   {
       return total;
   }
   ```

14. Write a getter for an attribute of type `string` named `myName`.
   
   Solution
   
   ```
   public string GetName()
   {
       return myName;
   }
   ```

15. Write a setter for an attribute of type `int` named `myAge`.
   
   Solution
   
   ```
   public void SetMyAge(int paramMyAge)
   {
       myAge = paramMyAge;
   }
   ```

16. Assuming `name` is a `string` instance variable, there is problem with the following setter. Fix it.
   
   ```
   public int SetName(string val)
   {
       name = val;
   }
   ```
   
   Solution
   
   It has the wrong return type, because it does not (and should not) return a value, i.e., replace `int` with `void`.

17. Assume we have an instance of the `Rectangle` class named `myRect` and an instance of the `Circle` class named `myCircle`. Write statement(s) that will make the radius of `myCircle` equal to the width of `myRect`.
   
   Solution
   
   ```
   myCircle.SetRadius(myRect.GetWidth());
   ```

18. Briefly describe what a format specifier is. Write a statement that uses one.
   
   Solution
   
   An indication to format a numerical value in a special way in a string. For example, `Console.WriteLine($"{65536:N}");` will display “65,536.00” on the screen after applying the `:N` format specifier to the value 65536.
19. Write a statement that uses a format specifier.

Solution

```csharp
Console.WriteLine("myInt:C");
```

20. Write a method for the `Rectangle` class that divides the length and width of the calling object by a factor given as a parameter.

Solution

```csharp
public void DivideBy(int factor)
{
    length /= factor;
    width /= factor;
}
```

21. Draw the UML diagram of a class named “Student” with a single attribute, “name”, of type `string`, and two methods, `SetName` and `GetName`.

Solution

```
Student-
- name: string
+ SetName(arg: string)
+ GetName(): string
```

22. Write a `ToString` method for a `Account` class with two attributes, a `string` attribute called `name` and a `decimal` attribute called `amount`.

Solution

```csharp
public override string ToString()
{
    return "$Account Name: {name}\nAccount Balance: {amount}";
}
```

23. Consider the following UML diagram:

```
Circle-
- radius : float
+ setRadius(radiusParam : float) : void
+ getRadius(): float
+ getArea(): float
```

What is the name of the class, what are the methods and attributes of the class?

Solution

The class is named Circle, it has a single attribute (radius) and three methods (setRadius, getRadius and getArea).

24. What does it mean to say that instance variables have a default initial value? How is that different from the variables we have been manipulating in the `Main` method?

Solution
When we create an object, the instance variable get a default value. When we declare a variable, it is unassigned.

25. Is it possible to have more than one constructor defined for a class? If yes, how can C# know which one is called?

Solution
Yes, by looking at the signature.

26. What is the name of a constructor method? What is the return type of a constructor?

Solution
The name of the class. It does not have a return type, not even void.

27. Write a constructor for a Soda class with one string attribute called name.

Solution
public Soda()
{
    name = "Generic";
}

28. Assume we have a Polygon class, that have only one attribute, an int called numberOfSides. Write a constructor for that class.

Solution
public Polygon (int numberOfSidesParam)
{
    numberOfSides = numberOfSidesParam;
}

29. What is the “default” constructor? Do we always have the possibility of using it?

Solution
The constructor provided with the class by default, that set all the attributes to their default values. If we define our own constructor, this one disappears.

30. What is the return type of a ToString method? How many arguments does it usually take?

Solution
string; 0.

31. Consider the following partial class definition:

    public class Book
    {
        private string title;
        private string author;
        private string publisher;
        private int copiesSold;
    }

    a) Write a statement that would create a Book object.
    b) Write a “getter” and a “setter” for the title attribute.
    c) Write a constructor for the Book class taking at least one argument (you are free to decide which one(s)).

Solution
a) Book myBook = new Book(); 2 and 3.

public string GetTitle()
{
    return title;
}

public void SetTitle(string titleP)
{
    title = titleP;
}

public Book (string titleP, string authorP, string pubP, int copiesP)
{
    title = titleP;
    author = authorP;
    publisher = pubP;
    copiesSold = copiesP
}

32. Consider the following partial class definition:

class DVD
{
    private string title;
    private decimal price;
}

a) Write a “setter” for the title attribute.
b) Write a constructor for the DVD class that takes two arguments.
c) Write a method called Discount that decreases the price attribute by 20.55%.
d) Write a (good, informative) ToString method for the class.
e) Write statements that ask the user to enter a price and then create a DVD object with a price attribute equal to the price the user entered. (The object’s title attribute can be anything you choose).
f) Draw the UML class diagram for the class you obtained by adding the above four methods to our original class definition.

Solution

class DVD
{
    private string title;
    private decimal price;

    public void SetTitle(string titleP)
    {
        title = titleP;
    }

    public DVD(string titleP, decimal priceP)
    {
        title = titleP;
        price = priceP;
    }

public void Discount()
{
    price -= price * 0.2055
}

public override string ToString()
{
    return $"DVD Title: {title}\nDVD Price: {price}";
}

//program.cs
Console.WriteLine("What should the price be for the movie "Ender's Game?";)
DVD myDVD = new DVD("Ender's Game", decimal.Parse(Console.ReadLine()));

Note: This is not the only answer, but is the most optimal.

33. Consider the following partial class definition:

class Book
{
    private string title;
    private decimal price;
}

a) Write a “getter” for the title attribute.
b) Write a constructor for the Book class that takes two arguments.
c) Write a method called AddTaxes that increases the price attribute by 6.35%.
d) Write a (good, informative) ToString method for that class.
e) Write statements that ask the user to enter a price and then create a Book object with a price attribute equal to the price the user entered. (The object’s title attribute can be anything you choose).
f) Draw the UML class diagram for the class you obtained by adding the above four methods to our original class definition.

Solution

class Book
{
    private string title;
    private decimal price;

get
{
    public string GetTitle() { return title; }

    public Book(string titleP, decimal priceP)
    {

null

title = titleP;
price = priceP;
}

public void AddTaxes()
{
    price *= 1.0635m;
}

public override string ToString()
{
    return $"Book Title: {title}, Price: {price}.";
}

//program.cs
Console.WriteLine("What should the price be for the book "Ender's Game?");

---

Note: This is not the only answer, but is the most optimal.

34. Assume that my Pet class contains one custom constructor:

    public Pet(string nameP, char genderP){
        name = nameP;
        gender = genderP;
    }

What is the problem with the following statement?

Pet myPet = new Pet('M', "Bob");

Solution

The method has for parameters a string and a char, but the problematic statement calls it with a char and a string: the order of the arguments is wrong, it should be Pet myPet = new Pet("Bob", 'M');.

35. Why would one want to define a constructor for a class?

Solution

To be able to set the instance variables directly when creating the objects.
3.2 Part II – Problems

There is only one problem this time, and it is harder than what you’ll be asked to do during the exam. Being able to solve it is an excellent sign that you are ready.

1. You are going to design a class named Triangle. A triangle has three angles, but knowing the value of only two angles is sufficient to determine the value of the third, since they always add up to 180°. Hence, it is sufficient to have only two double attributes, angle1 and angle2. We want to define several methods:

   - a no-arg constructor that sets the value of angle1 to 60.0 and the value of angle2 to 60.0,
   - another constructor, that takes two arguments, and assigns to angle1 the value of the first argument, and assigns to angle2 the value of the second argument,
   - getters for angle1 and angle2,
   - a method that computes and returns the value of the third angle, that we name ComputeAngle3,
   - a method that rotate the triangle: the value of the first angle should be replaced with the value of the second angle, and the value of the second angle should be replaced with the value of the third angle.

a) Write the UML diagram for the Triangle class.
b) Write the full, compilable implementation of the Triangle class.

Solution

```
class Triangle
{
    private double angle1;
    private double angle2;
    public Triangle()
    {
        angle1 = 60;
        angle2 = 60;
    }
    public Triangle(double angle1Param, double angle2Param)
    {
        angle1 = angle1Param;
        angle2 = angle2Param;
    }
    public double GetAngle1()
    {
        return angle1;
    }
    public double GetAngle2()
    {
        return angle2;
    }
    public double ComputeAngle3()
    {
        return 180 - angle1 - angle2;
    }
    public void Rotate()
    {
        double temp = angle1;
        angle1 = angle2;
        angle2 = temp;
    }
}
```

```
public double ComputeAngle3()
{
    return 180 - angle1 - angle2;
}
public void Rotate()
{
    double oldAngle3 = ComputeAngle3();
    angle1 = angle2;
    angle2 = oldAngle3;
}

4 Homework #4

4.1 Part I — Questions

1. What is sequential processing?

   Solution
   When the code is executed sequentially, without any branching. It implies that the code is processed in the order in which it is presented in the source code: the statement at line $n$ will always be executed after the statement at line $n - 1$ and before the statement at line $n + 1$.

2. What is a decision structure?

   Solution
   A decision structure is a test and one or multiple statement blocks that may or may not be executed based on the outcome of the test. Selection and iteration are two examples of decision structures: in the first one, a statement block can be “skipped over” if the test evaluates to false, in the second one, a statement block can be repeated multiple times, as long as the test evaluates to true. A decision structure makes it possible to have portions of the code executed conditionally.

3. Decide if the following boolean expressions will evaluate to true or false:

   a) $3 > 2.0 \ & \ & \ false$
   b) $(4 \ !=\ 3) \ |\ | \ false$
   c) "A" == 'b' \ &\ & \ !\ false$
   d) (! false) == (true || 4 == 3)

   Solution
   i. false
   ii. true
   iii. false
   iv. true

4. Decide if the following Boolean expressions will evaluate to true or false:

   a) $3 > 2.0 \ |\ | \ true$
   b) $(4 \ !=\ 3) \ &\ & \ false$
   c) "A" == 'b' \ |\ | \ !\ false$
   d) (! true) == (true || 4 != 3)

   Solution
   i. true
   ii. false
iii. true
iv. false

5. For each of the following Boolean expressions, decide if it will evaluate to true or false:

a) ('y' == 'Y') && true
b) 6 + 2 < 8 || 3 > 4
c) (true && 4 == 3) == false
d) 4 > 4 && !false

Solution
i. false
ii. false
iii. true
iv. false

6. For each of the following Boolean expressions, decide if it will evaluate to true or false:

a) ('y' != 'Y') && true
b) 6 + 2 < 12 || 3 > 4
c) (true && 4 >= 3) == false
d) 13 <= 4 * 3 || !false

Solution
i. true
ii. true
iii. false
iv. true

7. What relational operator is used to determine whenever two values are different?

Solution
!=

8. How do you store the result of a Boolean expression?

Solution
In a variable of type bool. Its two possible values are true and false.

9. Give three relational operators, and then two logical operators.

Solution
Possible answers: <=, >=, ==, !=, >, < and !, &&, ||

10. What would be displayed on the screen by the following code?

```csharp
if (false)
{
    Console.WriteLine("Hello!");
}
Console.WriteLine("Hi!");
```

Solution
"Hi!

11. Is there a simpler way to write the expression over21 == true, assuming that over21 is a Boolean variable?

Solution
We can simply write over21, which will always evaluate to the same value as over21 == true.
12. Assume that $x$ and $y$ are two int variables that have already been initialized (i.e., declared and assigned), write an if statement that assigns 10 to $x$ if $y$ is (strictly) greater than 5.

Solution

```
if (y > 5) x = 10;
```

13. In C#, is there a difference between = and ==? Write a statement that uses =.

Solution

Yes, one equal sign serves to write assignment operator, and two equal signs serve to compare. An example of statement that uses comparison first and assignment second could be: if (x == 9)x = 12;

14. Assuming a name string was declared and initialized with a value given by the user, write an if statement that displays “I have the same name!” if name contains your first name.

Solution

```
if (name=="Clément")
    Console.WriteLine("I have the same name!");
```

15. Is the following statement correct, i.e., would it compile, assuming myFlag is a bool variable, and myAge is an initialized int variable?

```
if ( myAge > 20 )
{
    myFlag = true
}
```

Solution

No, the semi-colon should come before the closing brace.

16. If we write a statement that begins with if(false), then the IDE returns a warning, “Unreachable code detected”. What does it mean?

Solution

The IDE is warning us that the statements in the block will never be executed.

17. Write an if statement that prints “Bonjour!” if the value of the char variable lang is 'f'.

Solution

```
if (lang == 'f')
    Console.WriteLine("Bonjour !");
```

18. For each of the following boolean expressions, decide if it will evaluate to true or false when the boolean variables $x$, $y$ and $z$ are all set to true:

- $x || y && z$
- !$x || y && z$
- !(x || y) && (z || y)
- (!$x && x) || (!x || x)$

Do the same when they are all set to false.

Solution

For each expression, we give first the value if all the variables are set to true, then the value if all the variables are set to false.

- true, false
• true, true
• false, false
• true, true

You can check the answer using for instance the following code.

```csharp
using System;

class MainClass {
    public static void Main(string[] args) {
        bool x, y, z;
        x = true;
        y = true;
        z = true;
        Console.WriteLine(x || y && z);
        Console.WriteLine(!x || y && z);
        Console.WriteLine(!(x || y) && (z && y));
        Console.WriteLine((!x && x) || (!x || x));
        x = false;
        y = false;
        z = false;
        Console.WriteLine(x || y && z);
        Console.WriteLine(!x || y && z);
        Console.WriteLine(!(x || y) && (z && y));
        Console.WriteLine((!x && x) || (!x || x));
    }
}
```

19. Write a boolean expression that evaluates to true if a variable \(x\) is between 3 (excluded) and 5 (included).

Solution

\[ x > 3 \land 5 \geq x \]

20. Write an if-else statement that assigns 0.1 to \(z\) if \(y\) is greater or equal than 0, and that assigns \(-0.1\) to \(z\) otherwise.

Solution

```csharp
if(y >= 0){
    z = 0.1;
}
else{
    z = -0.1;
}
```

21. Write an if-else statement that assigns "Minor" to an already declared string variable \(\text{legalStatus}\) if \(\text{age}\) is strictly less than 18, and that assigns "Major" to \(\text{legalStatus}\) otherwise.

Solution

```csharp
if(age < 18){
    legalStatus = "Minor";
}
else{
    legalStatus = "Major";
}
```
22. Write an if-else statement that displays “It’s free for you!” if an int variable `age` is between 0 and 18, and “It’s $5.00.” otherwise.

Solution

```csharp
if (age <= 18 && age >= 0){
    Console.WriteLine("It's free for you!");
} else{
    Console.WriteLine("It's $5.00.");
}
```

23. Assume we initialized an int variable called `courseNumber` and a string variable called `courseCode`. Write a series of statements that will display:

a) “I'm taking this class!” if `courseNumber` is 1301 and `courseCode` is CSCI;
b) “That's my major!” if `courseCode` is CSCI;
c) “Is that an elective?” if `courseNumber` is greater than 3000; or
   d) “Is it a good class?” otherwise.

Your program should display exactly one message.

Solution

```csharp
if (courseNumber == 1301 && courseCode == "CSCI")
{
    Console.WriteLine("I'm taking this class!");
}
else if (courseCode == "CSCI")
{
    Console.WriteLine("That's my major!");
}
else if (courseNumber > 3000)
{
    Console.WriteLine("Is that an elective?");
}
else
{
    Console.WriteLine("Is it a good class?");
}
```

24. Assume we previously initialized an int variable called `graduationYear` and a string variable called `graduationSemester`. Write a series of statements that will display:

a) “I will graduate at the same time!” if `graduationYear` is 2023 and `graduationSemester` is Fall;
b) “I love this season.” if `graduationSemester` is Spring;
c) “That is in a long time!” if `graduationYear` is greater than 2025; or
   d) “I hope you'll have an in-person ceremony!” otherwise.

Your program should display exactly one message.

Solution

```csharp
if (graduationYear == 2023 && graduationSemester == "Fall")
{
    Console.WriteLine("I will graduate at the same time!");
}
else if (graduationSemester == "Spring")
```
{   
    Console.WriteLine("I love this season.");
}
else if(graduationSemester > 2025)
{
    Console.WriteLine("That's in a long time!");
}
else
{
    Console.WriteLine("I hope you'll have an in-person ceremony!");
}

25. Assume we previously initialized a char variable called myChar. Write a series of statements that will display if the character is...
   a) Uppercase
   b) Lowercase
   c) A number
   d) or none of those.

Your program should display exactly one message. Bonus: Make your message also display the ASCII value of the character.

Solution

if ((myChar >= 'a') && (myChar <= 'z'))
{
    Console.WriteLine($"Your character ({(int)myChar}) is lower-case!");
}
else if ((myChar >= 'A') && (myChar <= 'Z'))
{
    Console.WriteLine($"Your character ({(int)myChar}) is upper-case!");
}
else if ((myChar >= '0') && (myChar <= '9'))
{
    Console.WriteLine($"Your character ({(int)myChar}) is a number!");
}
else
{
    Console.WriteLine($"Your character ({(int)myChar}) is not a letter or number!");
}

26. What will be displayed on the screen by the following program?

    int x = 3, y = 2, z = 4;
    if (x > y) {z += y;}
    if (x > z) {y -= 4;}
    Console.WriteLine($"x is {x}, y is {y}, and z is {z}.");

Solution

"x is 3, y is 2, and z is 6."

27. What will be displayed on the screen by the following program?

    int x = 3, y = 2, z = 4;
    if (x >= z) {z += y;} else if (x != y) {z *= y;}
    y -= 4;
    Console.WriteLine($"x is {x}, y is {y}, and z is {z}.");
28. *(We’ll use the 24-hour clock, sometimes called “military time.”)* Assuming that an int variable hour has been initialized, write part of a program that would display on the screen “Good morning” if hours is less than or equal to 12, and “Hello” otherwise.

Solution

```csharp
if (hours <= 12)
{
    Console.WriteLine("Good morning!");
}
else
{
    Console.WriteLine("Hello");
}
```

29. Assuming that myString is a string variable, write a statement that prints “Hello, Melody!” if the value of myString is equal to Melody, and nothing otherwise.

Solution

```csharp
if (myString == "Melody")
{
    Console.WriteLine("Hello, Melody!");
}
```

30. What will be displayed on the screen by the following program?

```csharp
int x = 3, y = 2, z = 4;
if (y >= z) { z += y; }
else if (x != y) { if (false) { z -= 3; } else { z += x; }}
Console.WriteLine("$x is {x}, y is {y}, and z is {z}.";
```

Solution

x is 3, y is 2, and z is 7.

31. Rewrite, if possible, the three following if-else-if statements as switch statements:

```csharp
if (myLang == 'f')
{
    Console.WriteLine("Vous parlez Français ?");
}
else if (myLang == 'e')
{
    Console.WriteLine("Do you speak English?");
}
else if (myLang == 'd')
{
    Console.WriteLine("Sprechen Sie Deutsch?");
}
else
{
    Console.WriteLine("I do not know your language!");
}
```
if (myCity == "Augusta")
{
    Console.WriteLine("I also live here!");
}
else if (myCity == "Ithaca" || myCity == "Providence")
{
    Console.WriteLine("I used to live there!");
}
else
{
    Console.WriteLine("I never lived there.");
}

if (temp == 100.0)
{
    Console.WriteLine("It's ready!");
}
else if (temp >= 90.0)
{
    Console.WriteLine("Almost ready!");
}
else
{
    Console.WriteLine("You have to wait.");
}

If you think it is not possible or not feasible, explain why.

Solution

switch (myLang)
{
    case 'f':
        Console.WriteLine("Vous parlez Français ?");
        break;
    case 'e':
        Console.WriteLine("Do you speak English?");
        break;
    case 'd':
        Console.WriteLine("Sprechen Sie Deutsch?");
        break;
    default:
        Console.WriteLine("I do not know your language!");
        break;
}

switch (myCity)
{
    case "Augusta":
        Console.WriteLine("I also live here!");
        break;
    case "Ithaca":
        break;
    case "Providence":
        Console.WriteLine("I used to live there!");
        break;
    default:
("I never lived there.");
break;
}

The last one is impossible, since we cannot write ‘switch’ statements comparing all the possible float values!

32. Give an example of an if statement that could not be rewritten as a switch.

Solution

Any condition not making a simple comparison is a good attempt. For instance, trying to convert
if(age % 2 == 0){Console.WriteLine("Your age is even.");} into a switch would require to
list all the even values, which is not realistic.

33. Write a switch statement that sets a double discount variable to 0.5 if a string day variable contains
"Monday" or "Wednesday", 0.25 if day contains "Saturday", and 0.5 otherwise.

Solution

switch (day)
{
    case "Saturday":
    {
        discount = 0.25;
        break;
    }
    default:
    {
        discount = 0.5;
        break;
    }
}

4.2 Part II – Problems

This time, the two exercises do not require a computer, and are here to craft on your problem-solving skills.
Make sure you feel ready before starting them, try to do them with a limited amount of time and without
notes, and check your answer using your IDE.

1. Write a program that asks the user to write a country name and stores the user’s input into a
string variable. Then, compare that string with "france": if it is equal, then display at the screen
"Bienvenue en France !". Then, compare that string with "usa": if it is equal, then display at the screen
"Welcome to the US!". If the string is different from both "france" and "usa", then display at the screen "Welcome to" followed by the name of the country the user typed in. Can you think of
two ways to implement this program, one using if-else-if statements, the other using switch?

Solution

Console.WriteLine("Country?");
string c = Console.ReadLine();
switch (c)
{
    case "usa":
        Console.WriteLine("Welcome to the US!");
        break;
    case "fr":
     

2. You want to write a small program for an on-line printing company. Your program should ask the user to choose a format (10 × 15 centimeters, or 8 × 11 inches), ask if it is the first time the customer order through your company, and a number of copies. Then, calculate the total cost of printing those pictures, knowing that

- Printing a 10 × 15 centimeters picture costs $0.20, printing a 8 × 11 inches picture costs $0.25,
- A new customer gets a $3 coupon if the order is more than $5,
- A 10% discount is given if more than 50 copies were ordered,
- The two previous offers can be cumulated.

Display on the screen a message starting by “Welcome!” , then a new line, then “We cherish our new customers” if it is the first time the user uses your company, “, so we’re giving you a $3 discount!” if the user is allowed to get the coupon, then print the total and “You had a 10% discount!” if the user ordered more than 50 copies. See below for examples of execution, where the user input is underlined, and hitting carriage return is represented by ↵.

Enter 'c' for 10x15cm, anything else for 8x11in.
c ↵
Is this your first time here? Type 'y' for 'yes'.
y ↵
Enter a number of copies.
90 ↵
Welcome!
We cherish our new customers, so we are giving you a $3 discount!
Your total is $13.50. You had a 10% discount!

Enter 'c' for 10x15cm, anything else for 8x11in.
p ↵
Is this your first time here? Type 'y' for 'yes'.
Not at all ↵
Enter a number of copies.
120 ↵
Your total is $27.00. You had a 10% discount!

Solution

```csharp
Console.WriteLine("Enter 'c' for 10x15cm, anything else for 8x11in");
char sizeChoice = char.Parse(Console.ReadLine());
Console.WriteLine("Is this your first time here? Type 'y' for 'yes'.");
char firstTime = char.Parse(Console.ReadLine());
Console.WriteLine("Enter a number of copies");
int copies = int.Parse(Console.ReadLine());
decimal totalCost = sizeChoice == 'c' ? copies * 0.2m : copies * 0.25m;
if(firstTime == 'y')
{
    Console.WriteLine("Welcome!");
    string message = "We cherish our new customers"
    if(totalCost > 5m)
    {
```
totalCost -= 3m;
message += ", so we're giving you a $3 discount!"
;
} Console.WriteLine(message);
}
if (copies > 50)
{
    totalCost -= totalCost * 0.1m;
    Console.WriteLine($"Your total is {totalCost:C}. You had a 10% discount!");
} else
{
    Console.WriteLine($"Your total is {totalCost:C}."};

5 Homework #5

5.1 Part I — Questions

1. Assume you are given an un-assigned string variable letterGrade, and an already assigned float variable numberGrade. Write a small program that assigns "A" to letterGrade if numberGrade is between 100 and 90 (both included), "B" to letterGrade if numberGrade is between 90 (excluded) and 80 (included), etc., and "Invalid data" if numberGrade is strictly lower than 0 or strictly greater than 100. Should you use a switch statement or a if ... else if ... else?

Solution
An if ... else if ... else is the right structure for this task:

float numberGrade;
string letterGrade;
numberGrade = -60; // This is just an example, feel free to change it.
if (numberGrade > 100 || numberGrade < 0)
{
    // It's actually easier to get rid of the "invalid" cases first.
    letterGrade = "Invalid Data";
}
else if (numberGrade >= 90)
{
    letterGrade = "A";
}
else if (numberGrade >= 80)
{
    letterGrade = "B";
}
else if (numberGrade >= 70)
{
    letterGrade = "C";
}
else if (numberGrade >= 60)
{
    letterGrade = "D";
}
else
{
    // We know the value is greater than 0 but strictly lower than 60.
    letterGrade = "F";
}
Console.WriteLine(numberGrade + " corresponds to " + letterGrade);

2. Given an int variable counter, write three statements to decrement its value by 1.

Solution
We actually know four ways to do that:

    counter = counter - 1;
    counter -= 1;
    counter--;
    --counter;

3. What will be displayed on the screen?

    int x = 3, y = 7;
    Console.WriteLine(x++ + " and " + --y);

Solution
"3 and 6"

4. What will be displayed on the screen by the following program?

    int counter = 2;
    while (counter != 5)
    {
        Console.Write(counter + "\n");
        counter++;
    }

Solution
2
3
4

5. What will be displayed on the screen by the following program? Write the spaces and new line explicitly.

    int counter = 10;
    while (counter > 5)
    {
        counter--;
        Console.Write(counter + "\n");
        if (counter == 7) {
            Console.WriteLine("Bingo");
        }
    }

Solution
6. What will be displayed on the screen by the following program?

```csharp
int counter = 10;
while (counter != 5) {
    Console.Write(counter + "\n");
    counter--;
}
```

Solution

Nothing, and it will loop forever.

7. What will be displayed on the screen by the following program?

```csharp
int counter = 7;
while (counter != 2) {
    Console.Write(counter + "\n");
    counter--;
}
```

Solution

7 infinitely many times.

8. What is input validation? Name a control structure that can be used to perform it. Why is it important?

Solution

Making sure the user’s input is valid. The while loop. Because we cannot trust the user.

9. What do we name a variable that is increased by some value at every iteration of a loop, i.e., that keeps the running total?

Solution

An accumulator.

10. What is a sentinel value?

Solution

It’s a value that will trigger an exit from a loop. It is a value that was agreed on, and that signifies “I now want to exit the loop.”

11. Write a program that asks the user to enter a value between 0 and 10, and asks again as long as the user enters integers outside that range.

Solution

```csharp
int answer;
do{
    Console.WriteLine("Enter a value between 0 and 10 (both included). ");
    answer = int.Parse(Console.ReadLine());
}while(answer > 10 || answer < 0);
```
12. Write a small program that asks the user for an integer, and displays “It is positive” if the number entered is positive, “It is negative” if the number entered is negative, and “Not a number” if the user entered a string that is not an integer.

Solution

```csharp
int answer;
Console.WriteLine("Enter an integer");
if(!int.TryParse(Console.ReadLine(), out answer)){
    Console.WriteLine("Not a number");
} else if (answer > 0){
    Console.WriteLine("Positive");
} else {
    Console.WriteLine("Negative");
}
```

13. Write a program containing a `while` loop that would display the numbers between -100 and 100 (both included) with a space between them when executed.

Solution

```csharp
int counter = -100;
while(counter <= 100){
    Console.Write(counter++ + " ");
}
```

14. Assume you are given an initialized `string` variable `name`, and a `string` variable `field`. Write a small program that assigns to `field`

- “CS” if `name` is “Turing” or “Liskov”,
- “Math.” if `name` is “Aryabhata” or “Noether”,
- “Unknown” otherwise.

Solution

```csharp
string name;
name = "Turing"; // Value given as an example, change it to test.
string field;
switch(name){
    case("Turing"):  
        case("Liskov"): 
            field = "CS";
            break; 
    case("Aryabhata"): 
        case("Noether"): 
            field = "Math.");
            break; 
    default:
        field = "Unknown";
        break; 
}
Console.WriteLine(name + " worked in " + field + ".");
```

15. Write a program that asks the user to enter a value between 1900 and 1999 (both included), and asks again as long as the user enters integers outside that range.

Solution

```csharp
33
int answer;
do{
    Console.WriteLine("Enter a value between 1900 and 1999 (both included). ");
    answer = int.Parse(Console.ReadLine());
}while(answer < 1900 || answer > 1999);

5.2 Part II – Problems

1. Write a switch statement that calculates the number of days in a particular month. You should assume that you are given already assigned month and year int variables, and that your program should set an already declared int numberOfDays variable to 28, 29, 30 or 31 depending on the month / year combination. Your program should start with a switch matching month against certain values, and, if month is 2, uses an if statement to decide whenever the number of days is 28 or 29. You can use something like

   switch (month) {
       case 1:
       case 3:
       case 5:
       case 7:
       case 8:
       case 10:
       case 12:
           numDays = 31;
       break;
       case 4:
       case 6:
       case 9:
       case 11:
           numDays = 30;
       break;
       case 2:
           if (((year % 4 == 0) && !(year % 100 == 0))
               || (year % 400 == 0))
               numDays = 29;
           else
               numDays = 28;
           break;
       default:
       Console.WriteLine("Invalid month. ");
       break;
   }

   Console.WriteLine("Number of Days = " + numDays);
6 Homework #6

6.1 Part I — Questions

1. Write a statement that creates a 10-element int array named numbers.
   Solution
   ```java
   int[] numbers = new int[10];
   ```

2. In the following, what is the value of the size declarator? What is the value of the index?
   ```java
   int[] numbers;
   numbers = new int[8];
   numbers[4] = 9;
   ```
   Solution
   The size declarator is 8, the subscript, or index, is 4.

3. What is wrong with the following array declaration?
   ```java
   int[] books = new int[-1];
   ```
   Solution
   The size declarator cannot be negative.

4. Draw the content of the scores array once those statements have been executed.
   ```java
   int[] scores = new int[3];
   scores[0] = 13;
   scores[2] = 25;
   ```
   Solution
<table>
<thead>
<tr>
<th>index</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>13</td>
<td>0</td>
<td>25</td>
</tr>
</tbody>
</table>

5. What will be displayed on the screen by the following program?
   ```java
   for (int num = 3 ; num <= 5 ; num++)
      Console.Write(num + " ");
   ```
   Solution
   3 4 5

6. Write a ‘for’ loop that displays on the screen the sequence “1, 2, 3, 4, 5, 6, 7, 8, 9, 10, ”.
   Solution
   ```java
   for (int x = 1 ; x <= 10 ; x++)
      Console.Write(x + ", ");
   ```

7. Write a ‘for’ loop that displays on the screen the sequence “1, 2, 3, 4, 5, 6, 7, 8, 9, 10”, (note that there is no comma after 10).
   Solution
for (int x = 1 ; x <= 10 ; x++)
{
    Console.Write(x);
    if (x < 10) Console.Write(", ");
}

8. Write a ‘for’ loop that displays on the screen the sequence “1 3 5 7 9”.
Solution

for (int x = 1 ; x <= 10 ; x+= 2)
    Console.Write(x + " ");

9. Given an int variable myVar initialized with a positive value, write a loop that sums the integers between 0 and myVar (i.e., 0 + 1 + · · · + (myVar − 1) + myVar).
Solution

int sum = 0;
for (int x = 1 ; x <= myVar ; x++)
    sum += x;

10. Consider the following code:

    for (int y = 1; y <= 3; y++)
    {
        for (int z = 1; z < 5; z++)
            Console.Write("Scene " + y + ", take " + z + ", ");
        Console.WriteLine();
    }

How many times does the outer loop iterate (i.e., how many scenes are shot)? How many times does the inner loop iterate (i.e., how many takes for each scene)? Finally, what is the total number of iterations of the nested loops (i.e., how many takes are made, total)?
Solution

3, 4, 12.

11. Which of the following are pre-test loops? do while, switch, while, for and if-else-if.
Solution

for and while are pretest loops.

12. What will be displayed on the screen by the following code?

    int[] values = new int[6];
    for (int i = 0 ; i < 6 ; i++)
        values[i] = (i*2);
    foreach (int j in values)
        Console.WriteLine(j);

Solution

0
2
4
6
8
10
13. Suppose we are given an **int** array `dailyPushUp` with 7 elements. Write a piece of code that display the value of the elements stored in the array `dailyPushUp`.

   **Solution**
   ```csharp
   for (int j = 0; j < 7; j++)
       Console.WriteLine(dailyPushUp[j]);
   ```

14. What is “array bounds checking”? When does it happen?

   **Solution**
   It is C# making sure that you are not using a subscript outside the allowed range. It happens at run time.

15. Is there an error with the following code? If you think there is one, explain it, otherwise draw the content of the `myIncomes` array once those statements have been executed.

   ```csharp
   double[] myIncomes = new double[5];
   myIncomes[1] = 3.5;
   // No income on day two.
   myIncomes[3] = 5.8;
   myIncomes[4] = 0.5;
   myIncomes[5] = 1.5;
   ```

   **Solution**
   The subscripts are off, they should go from 0 to 4: `myIncomes[5] = 1.5;` will cause an error.

16. What would be the size of the `test` array after the following statement has been executed?

   ```csharp
   int[] test = {3, 5, 7, 0, 9};
   ```

   **Solution**
   5

17. What is the difference, if any, between the following two statements?

   ```csharp
   int[] num, scores;  
   int num[], scores;  
   ```

   **Solution**
   In the second one, only **num** is a reference to an **int** array, and **scores** is just an **int**.

18. Write a statement that creates and initializes a **double** array with the values 12.5, 89.0 and 3.24.

   **Solution**
   ```csharp
   double[] question = {12.5, 89.0, 3.24};
   ```

19. What is the value of **count** and the content of **number** once the following has been executed?

   ```csharp
   int count=2;  
   int[] number={3, 5, 7};  
   number[count--] = 8;  
   number[count]--;  
   ```

   **Solution**
   count is 1. numbers is 3, 4, 8.
20. Suppose we have an array named `temp` that has been declared and initialized. How can we get the number of elements in this array?

   Solution

   By using the `Length` field: `temp.Length`.

21. Describe what the following code would do.

    ```csharp
    int[] record = { 3, 8, 11;};
    int accumulator = 0;
    foreach (int i in record)
        accumulator += i;
    ```

   Solution

   Declare and initialize an `int` array with the values 3, 8 and 11, and then sum those values in an accumulator variable.

22. Assuming we have two `int` arrays of the same size, `firstA` and `secondA`, write a program that copies the content of `firstA` into `secondA`.

   Solution

   ```csharp
   for (int k = 0 ; k < firstA.Length ; k++)
       secondA[k] = firstA[k];
   ```

23. Assuming we are given an `int` array named `arrayF`, write a program that adds one to each of its elements. That is, if `arrayF` contains 3, 5, 7 and -2 before your program is executed, it should then contain 4, 6, 8 and -1 after your program was executed.

   Solution

   ```csharp
   for (int k = 0 ; k < arrayF.Length ; k++)
       arrayF[k] += 1;
   ```

24. Assuming we are given an `int` array named `arrayF`, write a program that displays the product of its elements. That is, if `arrayF` contains 2, 3 and -1, then your program should display -6.

   Solution

   ```csharp
   int prod = 1;
   for (int k = 0 ; k < arrayF.Length ; k++)
       prod *= arrayF[k];
   Console.WriteLine(prod);
   ```

25. Write a static method (header included) that takes as argument an `int` array, and display on the screen the value of each element of that array.

   Solution

   ```csharp
   public static void p(int[] a){
       foreach (int k in a)Console.WriteLine(k);
   }
   ```

26. Write a static method (header included) that takes as argument an `int` array, and stores the value 10 in each element of that array.

   Solution

   ```csharp
   public static void z(int[] a){
       for (int j = 0 ; j < a.length ; j++) a[j]=10;
   }
   ```
7 Quizzes

Those quizzes are given as *examples*, to help you practise. They were given at week 4 and 7.

7.1 Quiz 1

1. (3 pts) List three keywords.

   Solution
   
   Keywords are words that have special meanings and cannot be used as identifiers in your program. Examples of C# Keywords include `int`, `string`, `if`, `while`, `void`, `else`, `bool` etc.

2. (4pts) Circle the correct identifiers:

   • `%Rate`
   • `static`
   • `my-variable`
   • `User.Input`
   • `YoUrNaMe21`
   • `test_train`
   • `_myIdentifier`

   Solution
   
   Valid identifiers can not include reserved words, can not start with a number, and must contain only numbers, letters, and/or the underscore character. The identifiers below follow these rules.
   
   `my-variable YoUrNaMe21 test_train _myIdentifier`

3. (4 pts) For each of the following, indicate if they are a “rule” of C# or a “convention” between programmers by ticking the appropriate column. The first answer is given as an example.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rule</th>
<th>Convention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code should be commented.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Case matters.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Variable names should be descriptive.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Keywords cannot be used as identifiers.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Each “.cs” file should contain exactly one class.</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

   Solution

<table>
<thead>
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</thead>
<tbody>
<tr>
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<td>✓</td>
<td></td>
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<td>✓</td>
</tr>
<tr>
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<td>✓</td>
</tr>
<tr>
<td>Each “.cs” file should contain exactly one class.</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

4. (4 pts) Write a statement that would display, “Hi Mom!” (*with* the quotes) followed by a new line on the screen.

   Solution
   
   The key is to escape the " character: `Console.WriteLine("\"Hi Mom!\"")`
5. (5 pts) Write a series of statements that would
   a) declare an int variable called “myAge”,
   b) assign your age to that variable,
   c) display “My age is”, the value of the “myAge” variable, a period, and finally a new line.

Solution

```csharp
int myAge;
myAge = 21;
Console.WriteLine("My age is " + myAge + ".");
```

6. (Bonus) Give examples of situations where the adage “Spaces and new lines don’t matter in programs” is actually erroneous.

Solution

Spaces and newlines matter when they are used in string data, as whitespace in strings is formatted exactly how it’s typed. Whitespace also matters inbetween words: words in C# must have at least one space between them in order to be compiled correctly (e.g. `static void Main()` and `int days = 7;`). If there were no spaces in either of the examples, neither of them would compile. They also matter for in-line comments.

```csharp
// My comment
int x;
x = 10;
```

If you remove the first newline, the program would not compile.

### 7.2 Quiz 2

1. (2 pts) What is the relational operator used to determine whenever two values are equal?

Solution

The operator is two equal signs, `==`, not to be confused with a single equal sign, `=`, used for assignment.

2. (2 pts) Write a boolean expression that evaluates to `true` if a variable `yourName` is different from "Marc" and "Mark".

Solution

A possible solution is: `yourName !="Marc" && yourName !="Mark"`. Note that there was no need to write an `if` statement or a complete statement: only the expression was required.

3. (5pts) Write a boolean expression that evaluates to `true` if a variable `x` is between -10 (excluded) and 10 (included).

Solution

A possible solution is: `x > -10 && x < 10`

Note that there was no need to write an `if` statement or a complete statement: only the expression was required.

4. (3 pts) What will be displayed on the screen by the following program?

```csharp
int x = 5, y = 1, z = 2;
if (x != z || y < z) {x += y;}
if (z > y) {if (z % 2 == 0) {z -= 3;} else {z += x;}} else {x = y + z;}
Console.WriteLine("x is \{x\}, y is \{y\}, and z is \{z\}." predators)
```

```csharp
40
```
This program would display:

x is 6, y is 1, and z is -1.

Press any key to continue...

5. (8 pts) Assume we initialized a `string` variable named `month` and a `double` variable named `temperature`. Write a series of statements that will display exactly one of the following messages:

- “What a nice summer day!” if `month` is “July” and `temperature` is less than 90 (included);
- “Better wear a jacket!” if `temperature` is between 45 and 60 (both included);
- “Happy holidays!” if `month` is “December”; or
- “Have a nice day!” otherwise.

Solution

```csharp
if (month == "July" && temperature <= 90)
    Console.WriteLine("What a nice summer day!");
else if (temperature >= 45 && temperature <= 60)
    Console.WriteLine("Better wear a jacket!");
else if (month == "December")
    Console.WriteLine("Happy Holidays!");
else
    Console.WriteLine("Have a nice day!");
```

6. (Bonus) Give a program that displays “Leap year” if a `year` variable is
   
   a) divisible by 4; and
   b) not divisible by 100, unless it is also divisible by 400.

Your program should correctly identify 2000 and 2400 as leap years, and 1800, 1900, 2100, 2200, 2300, or 2500 as `not` leap years.

Solution

```csharp
if (year % 4 == 0 && (year % 100 != 0 || year % 400 == 0))
{
    Console.WriteLine("The year " + year + " is a leap year.");
}
else
{
    Console.WriteLine("The year " + year + " is not a leap year.");
}
```

7.3 Quiz 3

1. (7 pts) Write a `switch` statement that sets a `decimal` `price` variable to 1.50 if a string variable `iceCreamFlavor` contains "vanilla", 1.75 if it contains "chocolate" or "mint", and -1 otherwise.

Solution

```csharp
switch(iceCreamFlavor)
{
    case "vanilla":
        price = 1.50m;
        break;
    case "chocolate":
    case "mint":
```
price = 1.75m;
break;
default:
    price = -1;
break;
}

2. (2 pts) Write a statement that applies the increment operator in prefix position to a variable test.
Solution
The increment operator (++) in prefix position (that is, applied before anything else) applied to the variable test gives: ++test;

3. (3 pts) What will be displayed on the screen by the following program?
```csharp
int x = 10;
x--; while(x > 0){
    Console.Write(x);
}
```
Solution
This would display 9 (without new line or space) forever.

4. (8 pts) Write a while loop that displays “1 2 3 4 5 6 7 8 9 10 11 12 13” (spaces included!) at the screen.
Solution
There are numerous different ways of writing such a program. A compact one could be:
```csharp
int num = 1;
while(num <= 13).Console.Write($"{num++} ");
```
while a more verbose could be:
```csharp
int num = 1;
while(num <= 13){
    Console.Write($"{num} ");
    num++;
}
```

5. (+3+2 pt, bonus) Give a program that displays every multiple of 3 between 0 and 10,000 (that is, “0 3 6 9 12 ... 9999”). Bonus (again!): display how many such numbers there are in total.
Solution
We can either
a) Display the counter only if it is a multiple of three:
```csharp
int counter = 0;
while(counter <= 10000){
    if (counter % 3 == 0) {Console.Write(counter + " ");}
    counter++;
}
```
b) Increment the counter 3 by 3:
int counter = 0;
while(counter <= 1000){
    Console.Write(counter + " ");
    counter+=3;
}

To answer the “bonus within the bonus”, we need two counters:

int threeCtr = 0; // Counter for the multiple of 3.
int multipleCtr = 0; // Counter that sum the number of values displayed
while(threeCtr < 10000)
{
    Console.Write("\{threeCtr\} ");
    threeCtr += 3; // We move to the next multiple of 3.
    multipleCtr++; // We increment the number of values displayed.
}

Console.WriteLine("\nThere are \{multipleCtr\} multiples of 3 from 0 to 10,000.");