ICS3U Investigation 3: Data Types

Example 1:

Recall that a program follows the IPO model (Input, Process, and Output).

```
public static void main(String[] args)
{
      String message1;
      int  triangleBase,triangleHeight, area;

      triangleBase = 6;
      triangleHeight = 4;
      message1 = "The area of the triangle is ";

      area = triangleBase*triangleHeight;

      System.out.print(message1);
      System.out.println(area);
}
```

1. **The code above is divided into different sections. What are each of the sections responsible for?**

Section 1 & 2 - Responsible for Input
Section 3 - Responsible for process
Section 4 - Responsible for output

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Example 2:

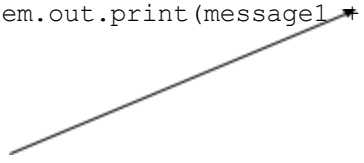
```
public static void main(String[] args)
{
      String message1;
      int  triangleBase,triangleHeight, area;

      triangleBase = 6;
      triangleHeight = 4;

      message1 = "The area of the triangle is ";
      area = triangleBase*triangleHeight /2;

      System.out.print(message1 + area);

}
```



2. **What does the "+" operator do here?**

In this code the operator “+” allows two variables to be joined in a string.

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Example 3:

Predict the output for the program below. Did you expect this output? Explain your findings.
My prediction for the program below was that it was going to output “cat” however the output turned out to be 312. Therefore, I did not expect this output as I did not know that the ASCII values are related to the char data type. In addition, this output came to be as in a char data type each letter has its own ASCII value represented in numbers and since the letter “c” “a” and “t” are being added, what's really happening is that their ASCII value is being added.
Example:

Letters (lowercase)	**ASCII Code**
c	99
a	97
t	116
Sum (+)	**312**

```
public static void main(String[] args)
{
	char firstLetter, secondLetter, thirdLetter;

	firstLetter = 'c';
	secondLetter = 'a';
	thirdLetter = 't';

	System.out.print(firstLetter + secondLetter + thirdLetter);
}
```

3. **What is a char data type? Which data type would you choose for your variables in order to output the word; "cat"?**.

Char data type is a primitive data type that stores a single character/letter or ASCII values. Furthermore, these characters must be surrounded by single quotes such as ‘A’ or ‘a’.

In order to output the word “cat” I would use the String data type as it can essentially hold more characters than char and it is also a lot bigger in magnitude.

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Example 4:

```
public static void main(String[] args)
{
	string message1;
	int  triangleBase,triangleHeight, area;

	triangleBase = 3;
	triangleHeight = 3;

	message1 = "The area of the triangle is ";
	area = triangleBase*triangleHeight/2;

	System.out.print(message1+area);
}		}
```

4. **Does the above program perform the correct calculation? In other words does it process correctly? Explain.**

The above program does not perform the right calculations as it does not process correctly due to the data type of the variable “triangleBase”, “triangleHeight” and “area” being int meaning that they only output a whole number. However, the area is not a whole number, instead it is 4.5 which is a fractional number. Thereofere, to correct this program you can use the data type of float, or double.

5. **Rewrite the program to correct for the error.**

Using float	**Using double**

String message1;
float triangleBase,triangleHeight, area;
 	
triangleBase = 3;
triangleHeight = 3;
 	
message1 = "The area of the triangle is ";
area = triangleBase*triangleHeight/2;
 	
System.out.print(message1+area);
	String message1;
	double triangleBase,triangleHeight, area;
	
	triangleBase = 3;
	triangleHeight = 3;
	
	message1 = "The area of the triangle is ";
	area = triangleBase*triangleHeight/2;
	
	System.out.print(message1+area);

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Example 5:

```
public static void main(String[] args)
{
	double decNumber;
	int intNumber;

	intNumber = 3;
	decNumber = intNumber;


	System.out.print(decNumber);
}
```

6. What does this program output? Is it what you expected? Explain
This program outputs 3.0.

I expected this output as the variable “decNumber” is a double meaning that the output of this variable will contain a decimal and since the variable “intNumber” gets assigned to “decNumber” the output will contain a decimal as well not matter if “intNumber” has a value of the type integer (whole number) .

7. This is an example of implicit conversion. What do you think ‘implicit conversion’ means?
Implicit converversion means that the compiler converts one data onto another type of data automatically. An advantage of implicit conversion is that no data is being lost.

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Example 6:

```
public static void main(String[] args)
{
	double decNumber;
	int intNumber;

	decNumber= 3.14159;
	intNumber= (int)decNumber;
	System.out.print(intNumber);
}
```

8. What does this program output? Is it what you expected? Explain.
This program outputs “3”.

I expected this output as the variable “intNumber” of the type int is being assigned to the value of “decNumber” of the type double. This conversion

from double to int worked as it specified the int which in parenthesis, in front of the variable “decNumber”.

9. **This is an example of explicit conversion. What do you think explicit type conversion means?**
   Explicit type conversion means that the compiler converts one data onto another type with the help of another predefined function. A disadvantage of explicit conversion is that data can be lost in the process of the conversion.

10. **A byte can assume two states (i.e. hold two types of variables: a byte and a bit) How many states can the following integer types assume**
    a. **Short** - int, long, char, double
    b. **Int** - long, float, double
    c. **Long -** float, double

11. **What is the largest positive integer that can be represented by each of the following types?**
    a. **Byte** - 2^7-1 or 255
    b. **Short** - 2^{15}-1 or 32767
    c. **Int** - 2^{31}-1 or 2147483647
    d. **Long** - 2^{63} -1 or 9.223372037 x 10^{18}

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12. **Which of the following conversions will require a cast?**
    a. int to char
    b. byte to int
    c. double to float
    d. float to short
    e. double to long
    f. int to float

13. **Write the output for the following segments of code. What conclusions can you make about the cast?**
    a.
    ```
    int i = (int) 87.65;
    System.out.print(i);
    ```
    The output will be 87 therefore it is an explicit conversion as you have to cast it and the some data is being lost from the original value of 87.65
    b.
    ```
    int j = (int) -32.99999;
    System.out.print(j);
    ```
    The output will be -32 therefore it is an explicit conversion as you have to cast it and some data is being lost from the original value -32.99999.

14. Find and correct the errors.

a. short s = 25;
int i – int(s);

- There is a negative in the cast instead of an “=” sign
- int should be in parenthesis instead of the variable “s”

b. int i = 50
short s = i;

- Missing semicolon (;) in the first statement.
- Did not cast when converting from int to short.