Java - Basic Constructs

C&G criteria: 1.2.6, 1.3.2, 2.2.3, 2.27, 2.4.2, 2.4.3, 2.4.4.

Constructs such as if, do and for are essentially identical to C or C++ and not that different to VB. Switch is also the same for C and C++ but VB programmers will recognise it as Select. Variables must be declared, unlike VB there is no default variant type. Contrary to C or C++ a method does not have to be declared before it is used. Arrays are a little different to C or VB although they work in basically the same way.

Number guessing

This program makes use of a Java library to create a random number. The user then has to guess the number.

```
public class Sort
{
	public static void main(String args[]) throws java.io.IOException
	{
		byte buffer[] = new byte[20];
		String temp=null;
		int iRand;
		int iGuess = 0;

		iRand = (int)(java.lang.Math.random()*20);//integer from 0 to 20
		System.out.println("Please enter a number");


		System.in.read(buffer); //get data from user
		temp=new String(buffer);
		temp=temp.trim();
		iGuess=Integer.parseInt(temp);
		System.out.println("You entered " + String.valueOf(iGuess));

		if(iRand = = iGuess) //compare to random number
			System.out.println("Correct ");
		else
			System.out.println("Nuumber was " + String.valueOf(iRand));

		for(long x=0;x<1000000;x++){} //wait

	}

}
```

Note that the code to get the data from the user is the same as has been used before. In good Java this would be a method within a Class. These early programs can be redone when Object Orientated programming has been introduced.

Grammar points

Experienced C programmers can skip this section.

1. When using if to compare date = = is used meaning 'is equal to', = means equals tempting Java to assign the value of one variable to the other.
2. If and else are not followed by ; Java sees the ; as the end of a line.

```
if(iRand = = iGuess) ; //is seen by Java as

if(iRand = = iGuess)
        ;   //do nothing
```

3. If selections are to take up more than 1 line the code resulting from the selection must be in braces. For a single line of code from the selection the braces can be skipped.
4. java.lang.Math.random() is the code to call the method random() from within the java.lang.Math library. It generates a double number from 0 to just below 1. For an integer the result needs multiplying up and casting (converting) to an integer. That is the function of the (int) code.

Modifications

1. Allow the user 3 attempts to guess the number. If not successful tell the user if he is hot, warm or cold after each guess.

cold = greater than 10 out
warm = greater than 5 out but not cold
hot = within 2 of the number

The for syntax can be used here

```
for(long x=0;x<1000000;x++){}  //runs from 0 to 1000000 and does nothing
```

The loop needs to run for 3 times only

```
//code to set iRand
for(int0;x<3x++)
{
        //code to capture data and compare to iRand
}
```

2. The user has plenty of scope for cock-ups by entering letters or numbers that are out of the random range. System.err can be used to send error messages to the console screen. This code handles numbers above 20.

```
if(iGuess>20)
{
        System.err.println("number converted to 20");
        iGuess = 20;
}
```

Modify this to handle numbers above 20 and below 0. The Java logical operators are && (And) and ||(or).

Handling letters is more complex as these throw an exception. Java exceptions are not always obvious, they can occur affecting how a program will run but may not stop the program from running. The result is a program that appears to be running but does not do what is expected due to the exception. Hopefully the exception name will be thrown up by the IDE, code can then be written to handle it.

The accepted approach is similar to if... else. If the exception is not thrown do this, else write some exception handling code to sort it out. In Java these code conditions are called try and catch. Try the code but if it fouls up catch it here. This code will sort out letters trying to be numbers.

```
try
{
        iGuess=Integer.parseInt(temp);
}
catch (NumberFormatException e)
{//not numeric
        System.err.println(e);
        iGuess = 1;  //set to a default
}
```

Sorting data

A quick and easy sorting routine is the bubble sort. This example sorts a set of 6 integers that are part of an array (number[5]), by using an array the for loop can cycle through the variables.

```
for (int iLeft = 0;iLeft<= 4; iLeft ++ )
{  //there are 5 members of the array, 0 to 4
        for (int iRight =0; iRight<= 4; iRight ++)
        {
                if (number[iLeft] > number[iRight])
                {
                        int iTemp =number[iLeft];
                        number[iLeft] = number[iRight];
                        number[iRight] = iTemp;
                }
        }
}
```

This code will generate suitable random numbers, sort them and output the results:

```
int number[] = new int [5];

for (int x = 0; x<number.length;x++)//note the length of the array is referenced
{ //use a for loop to put random numbers in the array
        number[x] = (int)(java.lang.Math.random()*20);
```

```
}
//the bubble swap code
for (int iLeft = 0;iLeft<= 4; iLeft ++ )
{
        for (int iRight =0; iRight<= 4; iRight ++)
        {
                if (number[iLeft] > number[iRight])
                {
                        int iTemp =number[iLeft];
                        number[iLeft] = number[iRight];
                        number[iRight] = iTemp;
                }
        }
}
for (int x = 0; x<number.length; x++)
{//use another for loop to output the data
        System.out.print ("Number " + String.valueOf(number[x]) + " ");
}
```

Grammar point

Arrays in Java have to be declared with the new word. This is a key Java word that will be well used to create Objects from Classes.

```
int number[] = new int [5];
```

Both sides of the assignment use [], a new array called number is created of the basic type int. It is of length 5 so will hold 4 members, 0, 1, 2, 3 and 4.

Modifications

1. Unlike C Java does not allow more variables to fit into an array than there is space. C will place the extra data into memory where it is bound to mess something up. Java detects the end of an array and throws an array out of bounds exception. Too long a for loop will throw this exception, for example running up to 5 in an array of 4 members.

Run the above code with 1 instance of 4 changed to 5 or more. This will throw up the full name of the exception. Then use try and catch to catch the exception, in this case the code does not have to be fixed to overcome the exception, just catch it.

2. Add code to accept a sequence of numbers and display them in both ascending and descending order.

3. Have the user input how long the sequence will be when the program runs.