Week 1

Sequence, Variables, Input and Output Class exercises

1 Ceebot Task 4.1: Follow a Path (using variables)

Your task

Program the **WheeledGrabber** to reach the platform that you can see in the distance. The path to take is marked out with blue waypoints (checkpoints). These are all **20 metres** apart.

- Use the **editor** to create the program.
- You will need to use the **move(…)** and **turn(…)** instructions.
- Notice that most programming instructions have brackets. These are called functions. Inside the brackets you can put a value (called a **parameter**) and this value is then passed to the function. In this case the parameter is the length the robot moves or the angle it turns.
- It is generally good programming practice to use **variables** (quicker to change values), so start by setting up some variables for the length and angle:

```
int  len;          // length
int  angle;
```

```
Algorithm
1.  Set length to ??
2.  Set angle to ??
3.  Move forward using length
4.  Turn using angle
5.  Move forward using length

etc.
```

Note: The **turn()** function will only accept an integer parameter. It uses the angle **anti-clockwise** so **90** will turn **right**; **-90** will turn **left**.

2 Task 5.3: RoboMaths

Your Task

Implement the algorithm displayed below:

- The final display should look like this:

  The answer is …
- You will need to use the **message(…)** instruction for the final display.

  (see your lecture notes or hit the [F2] key)

```
Algorithm
1.  Store 2 in variable a
2.  Store 8 in variable b
3.  Subtract 2 from variable b
4.  Multiply a by b and store result
5.  Display the result
```

Extra
Program the final message display so that it shows the contents of **all** the variables, like this:
Multiplying ... by ... gives …

3 Ceebot Task 6.3: Step by Step

This is another example of moving, but this time you have to use the dialog box to input numbers and also convert them from a string type to a number type. Your WheeledGrabber is at one end of the track and there are mines at the other end, just past a platform .. your destination.

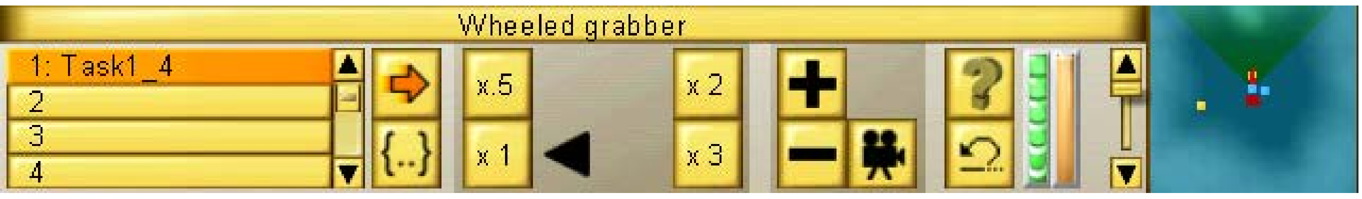
Your task is to reach the platform and survive, by asking the user to **input** a distance to move, then to move the robot through that distance. If you keep running the program, you should eventually reach your destination.

- You will need the **dialog(..)** instruction and also the **strval(..)** instruction to convert your string input into a number .. see the start of this unit for details.
- You should also try to input a distance to travel to the platform in **one** go!
- Unfortunately each time you reset the program, the platform distance will be different!
- Your main algorithm is:

```
Algorithm
  1. input a distance from the keyboard
  2. convert this to a number
  3. move this distance
```

4 Ceebot Task 1.6: Power up a Robot (use variables)

Notice that you can zoom in and out of a scene, by using the **+** and **-** buttons If you



zoom onto the **WingedGrabber** robot you will see that its energy level is zero (shown by the green indicator). This is because it has no power cell on board.
Your task is to get a powercell to the **WingedGrabber** using the **WheeledGrabber** ..

- Click on the WheeledGrabber robot, using the **editor** to create the program, as in the previous exercises.
- The following instructions will be useful for this task: (use **[F2]** for more details)
  - **move()** .. move forward .. the parameter is the distance **(use a variable)**
  - **grab()** .. picks up any object in front .. it has no parameter
  - **drop()** .. drops the object being carried .. normally has no parameter
  - **turn()** .. the parameter is the angle passed to it .. **(use a variable)**
- Work out the program algorithm by yourself. **[F1]** will show a picture of the scene with some useful distance information.
- When you have been successful, the WingedGrabber will fly off, because it already has been pre-programmed to do a task of its own.

Note: when the WingedGrabber flies off, you can follow it if you want to .. just click on its icon at the top left of the screen .. then try zooming and using the camera button too.

5 Ceebot Task 6.4 (variation) : Think of a number!

Use the algorithm below to write the program:

Algorithm

1. Input any value from the user and convert this to a float number
2. Double this number and store the result separately
3. Add 16 to the previous result
4. Divide the result by 2
5. Subtract the original number from this result
6. Display the final answer

Now run the program again, entering a different starter value .. what do you notice?
Can you explain why the program works this way?

6 Ceebot Task 6.5: Target Practice

Your task

- Write a program to input the horizontal and vertical angles and then use these to destroy one of the explosive targets.
- Your cannon should then be returned back to its starting position, ready for the next run of the program

Here is an **algorithm** that should help:

The shooter's cannon has two settings that are important:

- the vertical angle set by the **aim(…)** instruction (this can be between –20 and 20)
- the horizontal angle used by the **turn(…)** instruction (between –90 and 90 here)

Algorithm

1. **Input the vertical angle (-20 to 20)**
2. **convert this to a float number**
3. **Input the horizontal angle (-90 to 90)**
4. **Convert this to a float number**
5. **Aim the shooter**
6. **turn the shooter**
7. **Fire**
8. **Set the aim back to horizontal**
9. **Turn back to the starting position**
10. **Output a message "Ready to fire again"**

Testing the Program

A **Test Plan** has been partially completed for you.

- Run the program 3 times using the input data for the 3 existing tests and fill in the results.
- Then work out the values for Tests 4 and 5 and run these to complete the testing

Shooting Practice
Test Plan

Test No.	Input Angles Vertical	Horizontal	Expected Result	Actual Result
1	1	7	Target destroyed	
2	8	30	Target destroyed	
3	-3	-16	Target destroyed	
4			Target destroyed	
5			Target destroyed	

Week 1: The Technical Bit

1. Sequences

The **sequence** is a very important programming construct.
Basically, a sequence is a group of instructions or statements, where one instruction follows another in a particular order..
These instructions all end with **semicolons** and are put inside a set of **braces** to make what is known as a **block** of instructions .. like this:

```
{
      -----  instruction 1 ;
      -----  instruction 2 ;
      -----  instruction 3 ;
      -----  instruction 4 ;
}
```

The **order** of the instructions is very important and the skill of the programmer lies in putting the correct instructions together in the right order to achieve the task. All the programs you have written this week are sequences.

2. Algorithms (Pseudocode)

As programs get larger, it is very easy to get the order of the instructions wrong.
Good programmers design their programs before getting down to detailed coding. One of the techniques used to do this is the **algorithm** (also known as **pseudocode**)
An algorithm is just a plan for the program, written in structured english, usually with the various steps numbered in the correct order.
For example:

```
1.   move 20 metres forward
2.   turn 45 degrees right
3.   pick up object
4.   turn 180 degrees
5.   move 10 metres forward
6.   drop obect
7.   pause for 2 seconds
```

3. Variables

Often in a program, you want to store some value that may change later on in the program. Using a variable allows you to do this.

A variable is like a storage box .. you can have many boxes of different sizes … and so you don't forget what is in the box, you should give it a sensible name (or identifier)

A **variable** is a temporary storage 'box' in a program. You can use variables to store numbers, text, etc.   (see next page)

Declaring Variables

Every variable in a program needs to be set up by defining or **declaring** it before it can be used. This means giving the variable a **type** and a **name** (also called its **identifier**) :
e.g.

```
int  number ;        // defines number as a variable able to store an integer
float  wage ;        // defines wage as a variable able to store a decimal
                        (or floating point) number
string  surname ;    // defines surname as a variable able to store a string of characters
object  item ;       // defines item as a variable able to store object details
boolean  found ;     // defines found as a variable that can only be true or false
```

Assigning Values to Variables

Variables can be assigned values using the **=** operator
e.g.

```
number = 204;          // stores 204 in the number variable
wage = 20.25;          // stores 20.25 in the wage variable
surname = “Tita”;      // stores Tita in the surname variable
wage = wage * 2;       // changes the number stored in wage to 40.50
wage = number + wage + 10;     // stores 254.50 in the wage variable (204+40.50+10)
```

All of the above are examples of assignment statements

Output

Often you want to output information to the screen. In Ceebot this is done using the **message(…)** instruction .. this will print a message box onto the screen .. it will disappear in a few seconds. Here are some examples:

```
message("Hello Everyone");
message("My name is " + firstname + " and my age is " + age);
```

Notice you use "quotes" for strings of characters, but not for variables
Notice how the **+** operator is used to join strings and variables together into one message.

Input

You can also input information from the keyboard during a program. To do this you use the **dialog(…)** instruction. You will need to set up a string variable to store the input. e.g.

```
string  input;                              // set up a string variable called input
input = dialog("Where do you live?");    //  input words from the keyboard
```

Notice the dialog(…) instruction has a string parameter .. this is a **prompt** to the user and appears in a dialog box on the screen.

Note that if you want to input a **number** to be used later in the program, you will have to convert the input string to a number .. you can use **strval(…)** to do this. e.g.

```
string  input;          // set up a string variable called input
int  number;            // set up an integer variable called number
input = dialog("How many Targets can you see?");   //  input from keyboard
number = strval(input);    // convert input to a number
```