Module 5
Exploring Control

Learning Objectives

	Student is able to:	Pass/ Merit
1	Write a list of commands to produce a simple picture or design	P
2	Use repeat commands	P
3	Create complex shapes with varied angles	M
4	Name and run a procedure	M

5.1 Exploring control

MSWLogo

- Click 🪟 to open the Start menu.
- Click ▶ **All Programs**.
- Click 📁 **Microsoft Windows Logo** ▶.
- Use the commander to give instructions to the screen turtle.
- After typing each command, tap ⏎ Enter to execute the command.
  - To make the turtle move forward 100 units, type fd 100.
  - To make the turtle move forward 77 units, type fd 77.
  - To make the turtle turn 90° to the right, type rt 90.
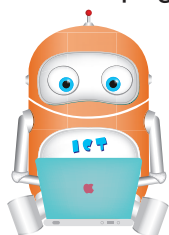 - To make the turtle turn 45° to the left, type lt 45.
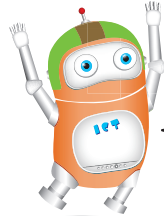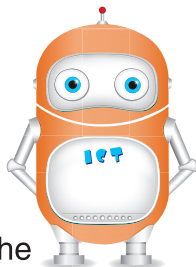
Put a space between the command and the number.
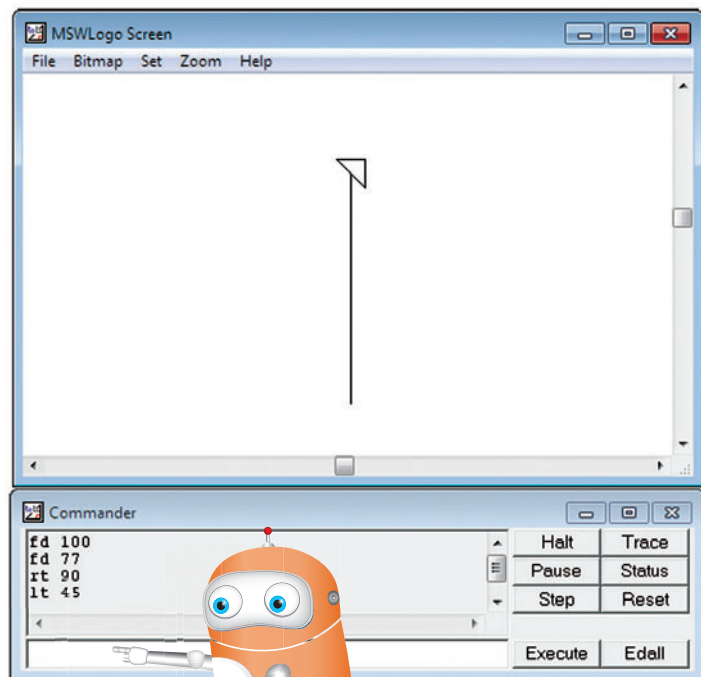
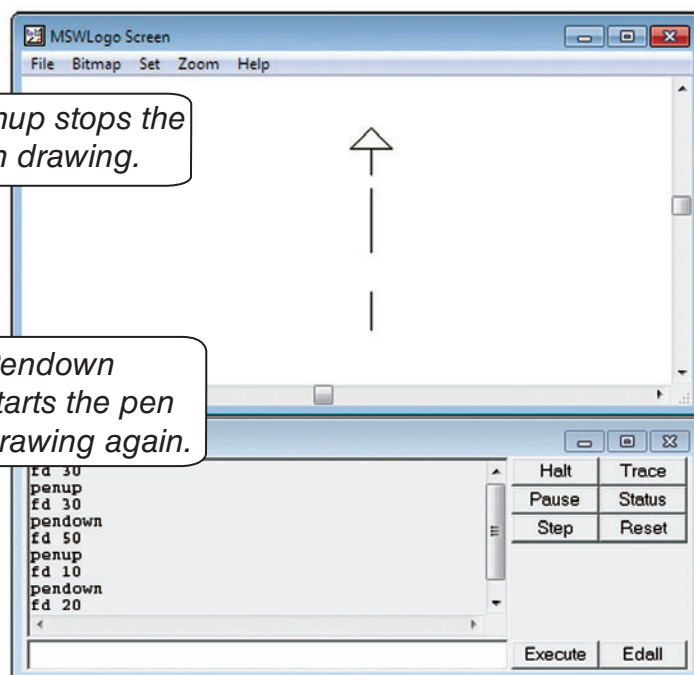*Type your instructions here.*

Penup and pendown

- Click **Reset** to start a new blank page.
- Type: fd 30
              penup

Penup stops the pen drawing.

- Type: fd 30
              pendown

- Type: fd 50
              penup
              fd 10
              pendown
              fd 20

Pendown starts the pen drawing again.

- Type: CT
  CT will clear all the texts in the commander box.
- Type: CS
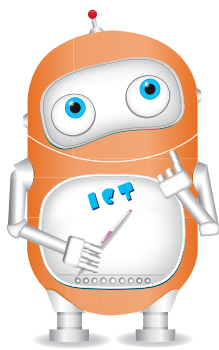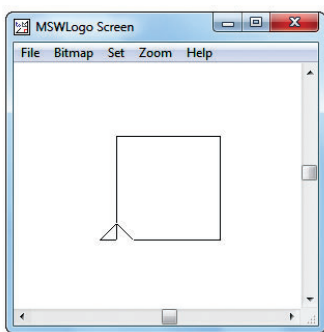 CS will clear the screen. It has the same effect as **Reset**.

Square

- Type the following list of commands to draw a square with sides of 100 units:
  - ○ fd 100 rt 90
  - ○ fd 100 rt 90
  - ○ fd 100 rt 90
  - ○ fd l00 rt 90
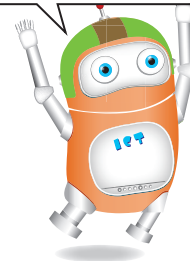
- Type the command penup.
- Move your turtle to a new position using the fd command.
- Type the command pendown.
- Draw another square with sides of 150 units.
- Write down the list of commands that you used to create the new square:

_____

_____

_____

_____

_____

Rectangle

- Type the following list of commands to draw a rectangle with width 100 and length 150 units:
  - ○ fd l00 rt 90
  - ○ fd l50 rt 90
  - ○ fd 100 rt 90
  - ○ fd l50 rt 90
- Type the command penup.
- Move your turtle to a new position using the fd command.
- Type the command pendown.
- Draw another rectangle with width 70 and length 170 units. Write the list of commands you used:

_____

_____

_____

_____
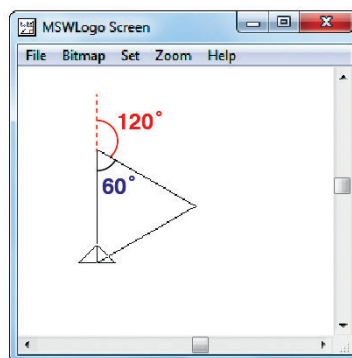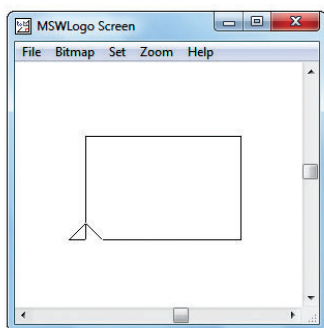
The sum of the interior (60°) and the exterior (120°) angles equals to 180°.

- Discuss and write down how you would draw a regular triangle with each side 130 units and each interior angle 60° (i.e. exterior angle 120°):

_____

_____

_____

_____

_____

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5.2 Turtle repeats

Learning Objective: 2

### Use repeat for drawing triangles, squares and rectangles

- You can use the repeat command to save time typing repeated commands when drawing triangles, squares and rectangles.
- To draw a regular triangle with sides of 75 units and exterior angle 120°, instead of typing fd 75 rt 120 3 times, you can type: repeat 3 [fd 75 rt 120]
- Execute the commands to test whether you have got the right shape.
- Change your commands for drawing 3 regular triangles with sides of 100, 150 and 250 units.

- Complete the commands below for drawing a square with sides of 100 units: repeat ___ [fd _____]
- Change the commands for squares with sides of 70, 90 and 120 units.
- Complete the commands below for drawing a rectangle with width 45 units and length 70 units: repeat___[fd_____fd_____]
- Change the commands to draw a rectangle with sides of 90 and 145 units.

Polygons

- Polygons are shapes with more than 4 sides.
- A regular hexagon has 6 equal sides and 6 equal exterior angles of 60°.
- To draw a regular hexagon with sides of 100 units, you need to type fd 100 rt 60 6 times.
- By using the repeat command you only need to type repeat 6 [fd 100 rt 60].
- Execute the commands.
- Do you get a regular hexagon?

*Make sure you leave a space between repeat and 6. Use square brackets only!*
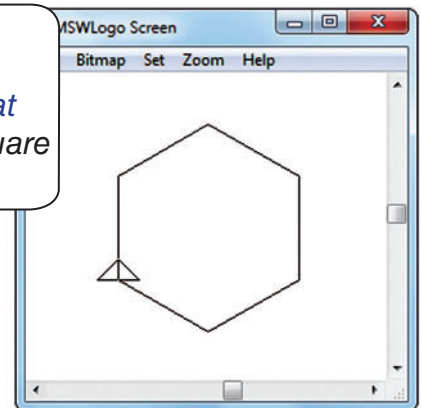
More polygons

- Complete the commands below to draw a regular pentagon with each side 70 units and each exterior angle 72°:
  repeat____ [_____]

- Write the commands using repeat to draw a regular octagon with each side 70 units and each exterior angle 45°:
  _____
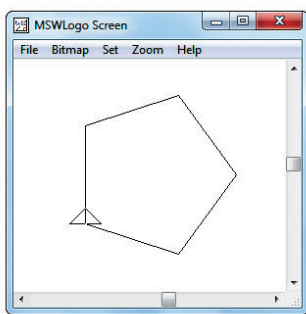
A pentagon has 5 sides and an octagon has 8 sides.

The exterior angle of a polygon = 360°/n, where n is the number of sides.
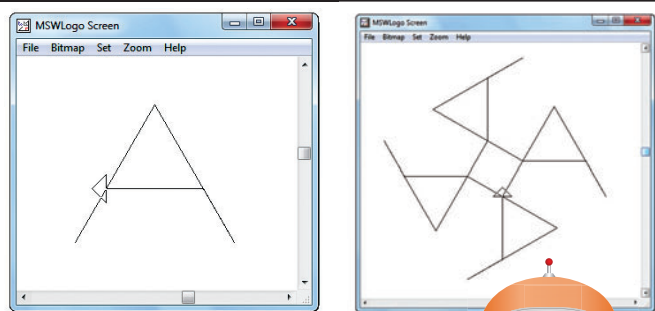

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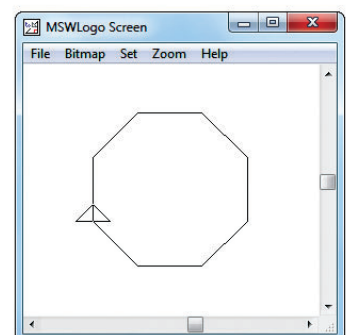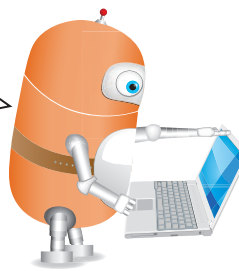
5.3 Varied angles

Learning Objective: 3

Patterns with varied angles

- Type the following list of commands to draw the letter A. Tap ↵ Enter at the end of each line.

  - rt 30 fd 180
  - rt 120 fd 180
  - bk 70 rt 120 fd 110

- Starting from the ending position of the turtle, type the list of commands another 3 times to form a flower pattern.

The pattern depends on the starting and ending positions. You may have a different pattern if your starting and ending positions are different.
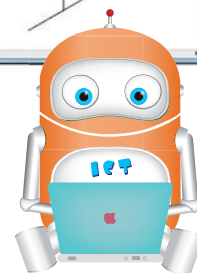
Letters K and M

- Write down the list of commands for forming the letter K (or any other letter that you like).
- You can use the sample as a guide or create your own picture.
- Test your list of commands.
- Change the list of commands when and where necessary.

  List of commands for K:

  _____
  _____
  _____
  _____
  _____
  _____
  _____

- When you have completed the picture, do a screenshot of your work and save it as an MS Word document.
- Print a copy of the image and glue it in your exercise book.
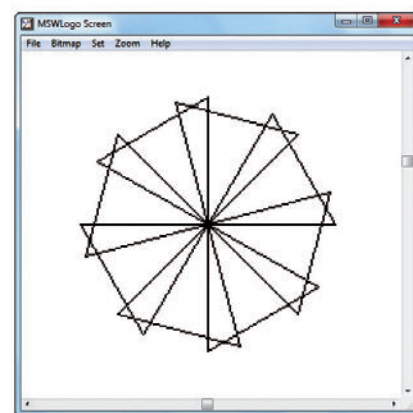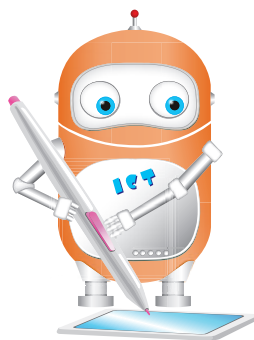- Repeat for 3 more letters, M, W and Z, or any letters of your choice.
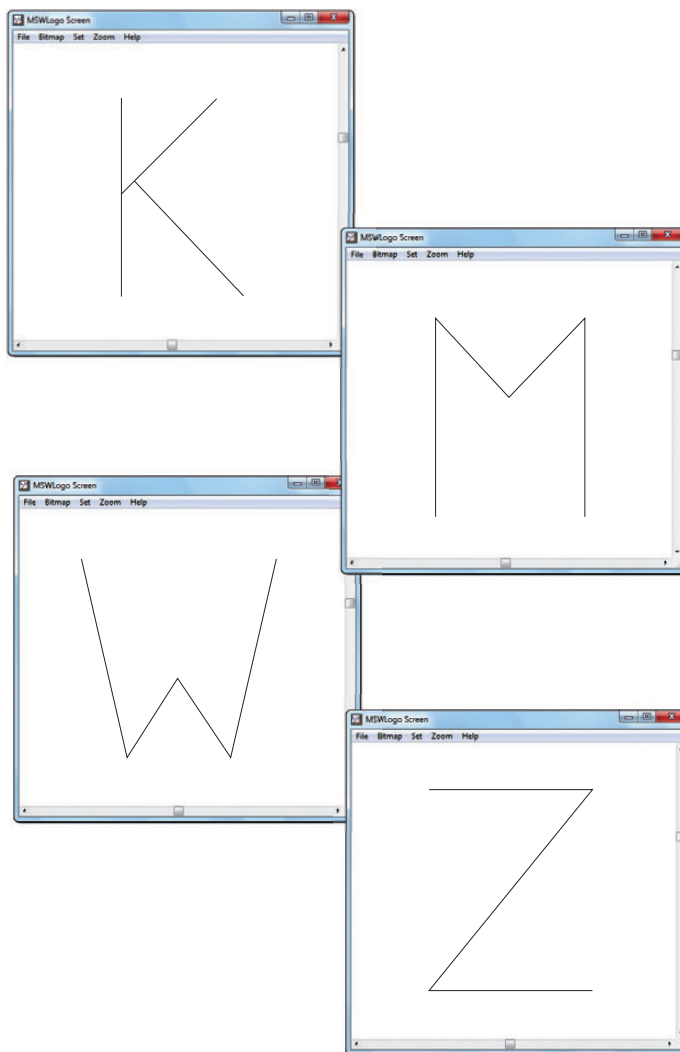
5.4 Pattern by rotation

Patterns by rotation

- Type and execute the following commands:
  repeat 3 [rt 120 fd 75] rt 45
- Execute the above commands 8 times and finally type: ht

> The command *ht* will hide the turtle so that the pattern is clearer. To see the turtle again, type *st* (show turtle).

More patterns

- Start a new drawing.
- Type CT CS to clear the text in the commander and to clear the screen.
- At the commander type:
  repeat 8 [repeat 4 [rt 90 fd 75] rt 45] ht
- You are actually repeating the drawing of a square (repeat 4 [rt 90 fd 75]) 8 times, but the turtle turns to the right 45° after drawing each square.
- Change the angle 45° to 20°, 30°, 60° etc. to create different patterns.
- You need to change the number of times the patterns are repeated in order to make complete patterns.
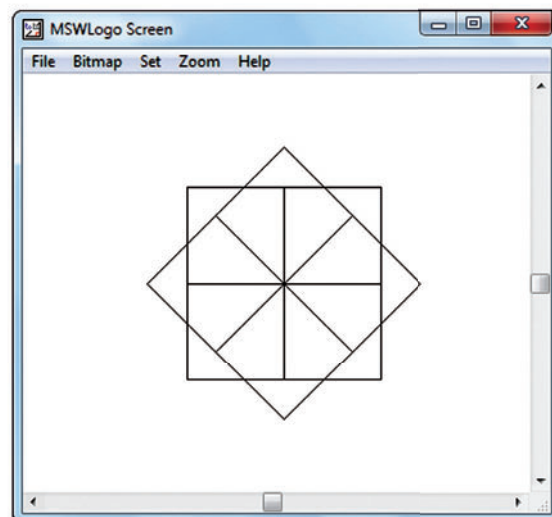
Flower patterns

- Type CT CS to clear the text in the commander and to clear the screen.
- Create your own flower patterns by completing the blanks below with appropriate numbers:
  repeat__[repeat__[rt__fd__] rt___]
- The command in blue can be a triangle, a square, a rectangle. You can also try a regular pentagon, a hexagon or an octagon.
- Test your command.
- Do a screenshot and save it as an MS Word document.
- Print a copy and glue it in your exercise book.

> Glue your flower pattern in your exercise book.
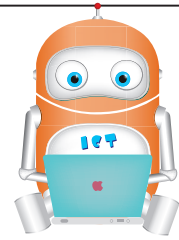

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5.5 Writing procedures

Learning Objective: 4

Procedures

*The problem with repeats is you can't save them.*

*Procedures let you save your shapes.*

Make a square procedure

- Click **File**.
- Select **Edit...**.
- Type square on the first row as the name of the procedure.
- Click **OK** to open the Editor.
- Place the cursor on the right side of the procedure name: to square.
- Tap **⏎ Enter** to insert a line.
- Type the command for drawing a square:
  repeat 4 [fd 55 rt 90]
- You can highlight the command repeat 4 [fd 55 rt 90]
  and click **Test!** to test the command.
- Make sure the last line end is not deleted.
- Click **File** under the Editor mode.
- Click **Save and Exit**.
- Type CT CS to clear the text in the commander and to clear the screen.
- To draw the square, just type at the commander:
  square and tap **⏎ Enter** to execute.
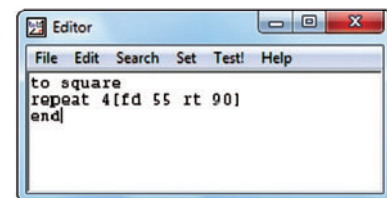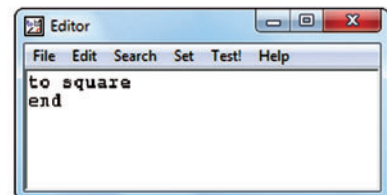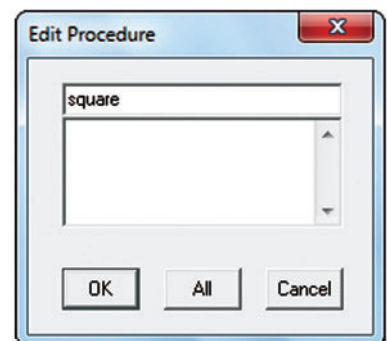
Procedure for shapes

- Repeat the previous exercise to create a procedure to draw a triangle.
- Create another procedure for drawing a regular pentagon, a regular hexagon and a regular octagon. Creating a procedure is called defining one.
- Before you leave Logo, save your file to keep the procedures.
- Click **File**.
- Click **SaveAs...**.
- Save your file as exercise1.lgo.
- You must load exercise1.lgo the next time you start Logo in order to use the procedures.

I like writing procedures. They save me a lot of time!

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CAMBRIDGE
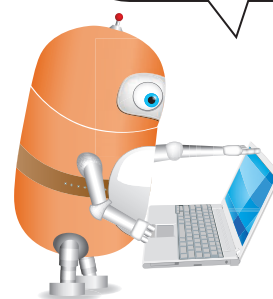
5.6 Repeat a procedure

Learning Objectives: 2, 4

Flower patterns

- You can tell the computer to repeat a procedure.
- If, after drawing the picture, your ending position is back to the starting position, you must tell the turtle to turn or move forward after drawing the first shape.
- Otherwise, if you use the repeat command to draw the shape many times, the turtle will only draw the same shape over and over again, at the same position.
- Load the file exercise1.lgo that you have saved in your previous exercise.
- Type at the commander:
  repeat 20 [triangle rt 18]

- Do the same by repeating a square, a hexagon, a pentagon and an octagon.
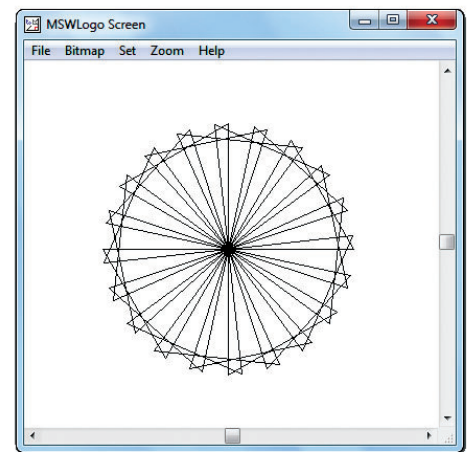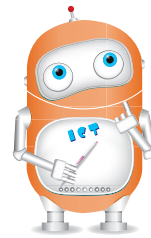

Complicated flowers

- You can make more complicated flowers by adding a slight forward movement, more repeats and different amounts of turns.
- Here is an example:
  - First define procedure square as
    repeat 4 [fd 55 rt 90]
  - At the commander type:
    repeat 20 [square rt 20 fd 10]
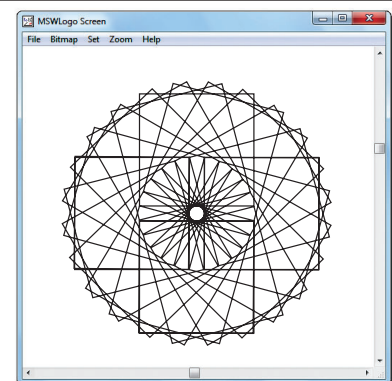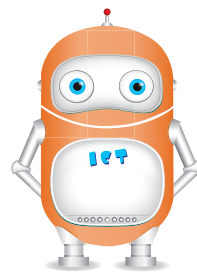
Mystery

- What shape do you think the procedure mystery below will create?
  lt 45 fd 30 rt 135 fd 10 lt 90 fd 40
  rt 90 fd 22 rt 90 fd 40 lt 90 fd 10
  rt 135 fd 30 rt 135
- Define the procedure mystery and find out what it is.
- Clear the screen.
- At the commander type:
  penup home pendown
  repeat 8 [mystery rt 45]
- Do a screenshot of the picture created and save it as an MS Word document flower1.

- Try another two patterns:
  repeat 30 [mystery rt 20]
  repeat 30 [mystery rt 20 fd 10]
- Start each pattern as a new bitmap.
- Do a screenshot of each pattern created and save them as pattern2, pattern3 respectively.
- Save the procedure as mystery.lgo.

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Learning Objectives: 2, 4
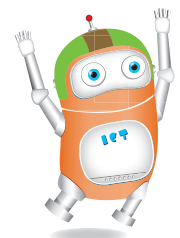
Letter pattern

- Refer back to the lists of commands for creating letters in exercise 5.3.
- You can create new lists of commands if you have not saved them.
- Define the procedure letter_Z for creating the letter Z.
- Leave the ending position as it is.
- Save the procedure as letter.lgo.
- Use the repeat command to create a flower pattern.
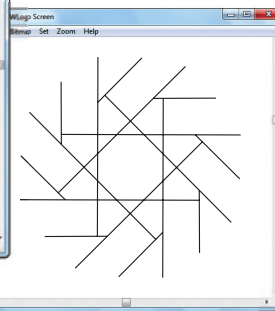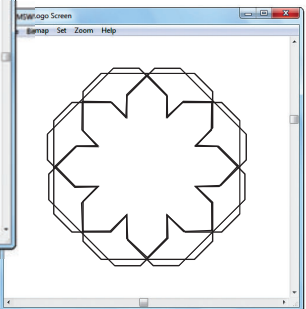- Example:
  repeat 4[letter_z]
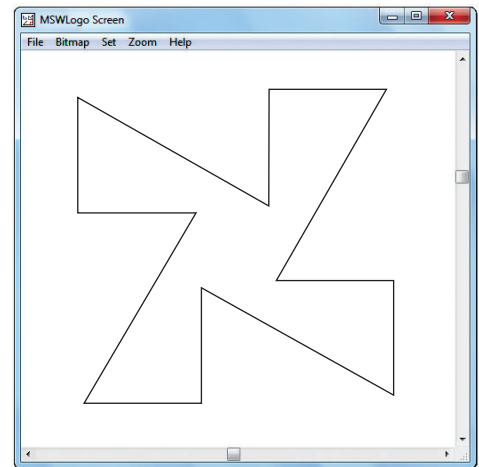
More letter patterns

- Define more procedures for creating letters.
- Save all these procedures under the same file letter.lgo.
- Use these procedures and the repeat command to form more patterns.
- The samples shown here are patterns formed by letters G, K and C.
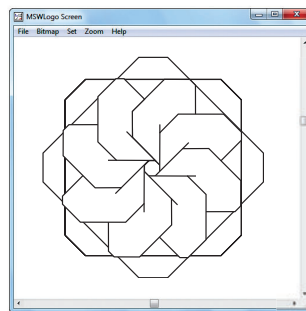

Pattern formed by letter G

Pattern formed by letter K

Pattern formed by letter C

Project

- Create a procedure flag to produce the flag as shown.
- Save the procedure as flag.lgo.
- Maximise the Editor window.
- Do a screenshot to capture the list of commands that you used to define the procedure flag.
- Save the capture as an MS Word document pro_flag.
- Use the flag procedure to produce a complicated pattern.
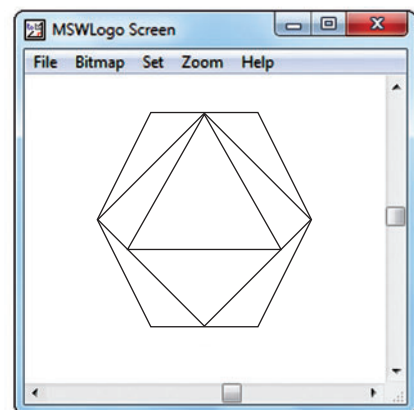- Do a screenshot and save it as an MS Word document FlagPattern.

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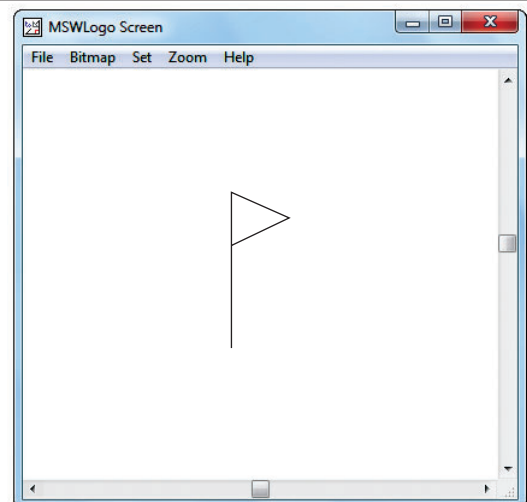
Optional extension and challenge activities

Module 5 – Exploring Control

Challenge 1

Use penup and pendown to draw a triangle inside a square inside a hexagon.

Challenge 2

- List the commands to draw a pentagon.
- Make a rotating pattern by programming the turtle to draw the pentagon 5 times using the repeat command and turning 72° after each repeat.

Challenge 3

- Define the procedure for creating a letter of your choice with the turtle.
- Save the procedure.
- Use the procedure and the repeat command to create a rotating pattern.