FLOWCHARTS

Part 1

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What is a flowchart?

- ✓ A **flowchart** is a way of visually representing an algorithm.
- ✓ An **algorithm** is a set of instructions or processes.

Flowcharts are **strict**. This is because computers need **SPECIFIC** instructions. We decompose large problems into smaller problems to form the instructions.

Each flowchart shape contains one SMALL part of the whole problem. We do not over-fill flowchart shapes with essay length instructions.

Basic shapes

These flowchart shapes are internationally recognised, so we must use them and **NOT** invent our own ones!

Terminator; This either contains START or END, and only one of each exists in a flowchart. They specify where the start and end of a flowchart is.

Input/output; We use this shape to show that something is going IN or OUT of the system we are designing. For example, we put a tea bag into a cup.

Process; We use this to show that something is happening. So, if I was to walk five steps forward, that is a process. It can't be an output or input as nothing is going in or out!
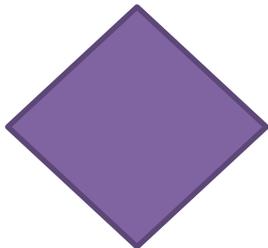
Decision; Decisions are used when we need to make a choice. Decisions MUST have two exits, one labelled YES and one NO. They are the only shape that has two exits. For example, "Is the kettle boiled?" This is either a YES or a NO...

How to draw flowcharts
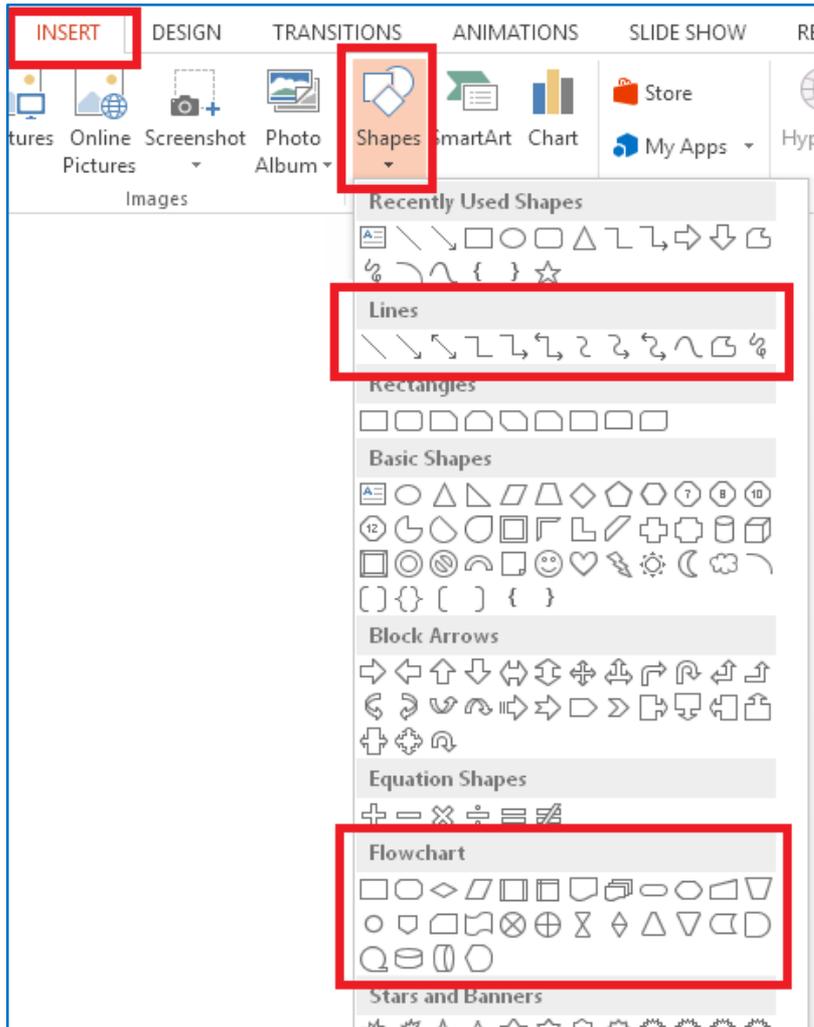
Most office products have shapes you can use in the insert menus (see screenshot to the left). Remember you can use lines to connect the shapes together.

Some good websites exist such as:

www.draw.io

Example 1 - *Getting a book out of a backpack.*

Start

Open zip

Remove book
from bag

End
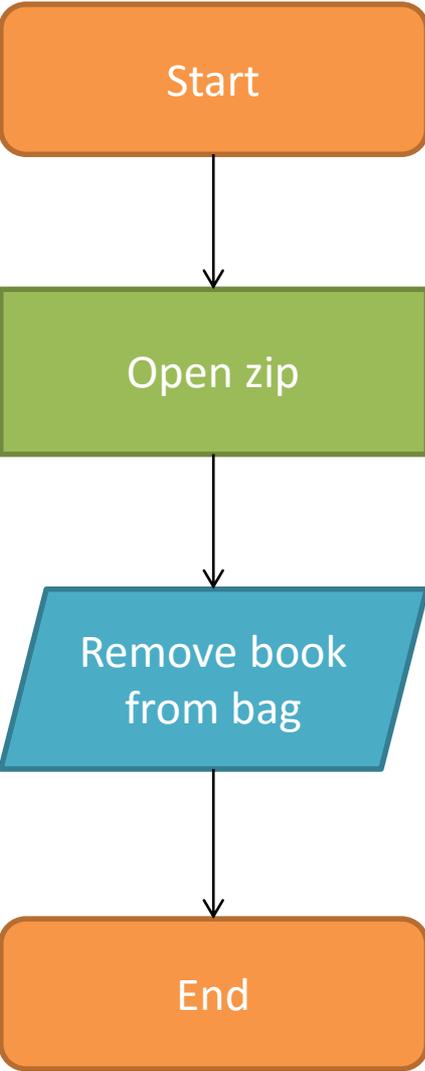
Example 1 - *Getting a book out of a backpack.* **Explained**

Start

I start all flowcharts with the **TERMINATOR** symbol. It only ever contains the word "START".

Notice how the FLOW of logic is represented by arrows… the logic here is going FROM 'Start' TO 'Open zip'.

Open zip

Opening the zip is a **PROCESS**, so I use the square here.

Remove book from bag

Removing the book is an **OUTPUT** from the system, so it uses the parallelogram shape.

End

I finish all flowcharts with the **TERMINATOR** symbol. It only ever contains the word "END". Remember I only have one of these in a flowchart. All routes must end up here!

Example 2 – *Determine if I have picked up a red pencil.*

```
                    Start
                      │
                      ▼
            Pick up a random
                 pencil
                      │
                      │          Yes ──────────▶  Say "The
                      │                           pencil is red."  ──────┐
                      │                                                   │
                      ▼                                                   ▼
                 Is the                                                 End
                 pencil                                                  ▲
                 red?                                                    │
                      │                                                   │
                      │          No ───────────▶  Say "The pencil ──────┘
                                                  is not red."
```

Example 2 – *Determine if I have picked up a red pencil.* **Explained**

Notice how decision boxes have two arrows leaving. One is always YES and one is always NO. They correspond to the route that should be taken depending upon the decision.

Pick up a random pencil

If the pencil **was** red in my decision... so "YES; it was red" then I follow the YES path out of the decision and end up here!

Say "The pencil is red."

Is the pencil red?

Yes

No

End

Say "The pencil is not red."

I cannot assume what colour the pencil is, so I must start be making a decision... is it RED? YES or NO?

If the pencil was **not** red in my decision... so "NO; it was not red" then I follow the NO path out of the decision and end up here!

Example 3 – *Determine if a kettle has boiled. If so, pour the water into a cup.*

Start

Turn on the kettle

Has the kettle boiled?

Yes

No

Pour water into cup

End

Example 3 – *Determine if a kettle has boiled. If so, pour the water into a cup.* **Explained**


Start

Turn on the kettle
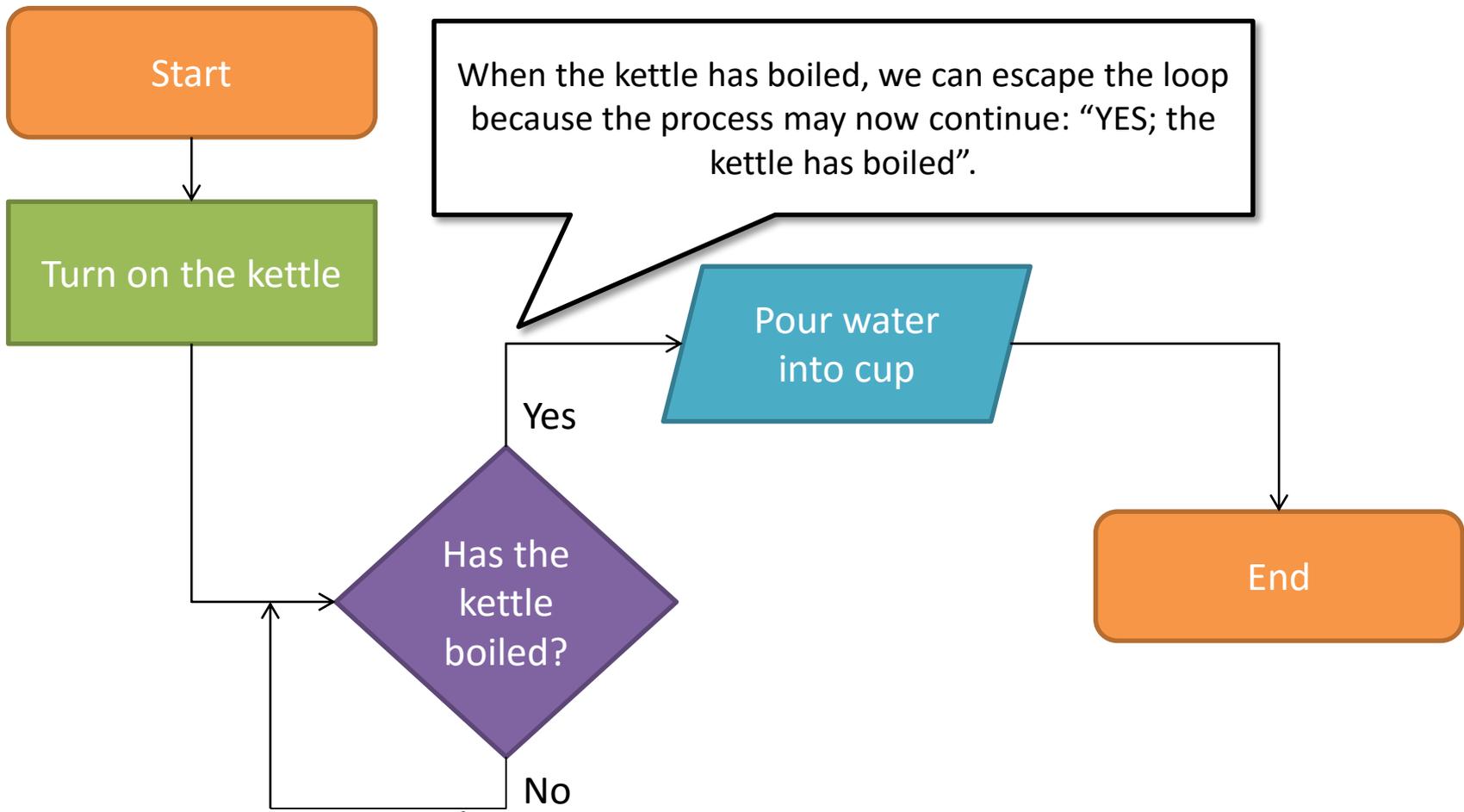
When the kettle has boiled, we can escape the loop because the process may now continue: "YES; the kettle has boiled".

Pour water into cup

Yes

Has the kettle boiled?

No

End

If the kettle has not boiled... can we continue with our process? NO! So we must **LOOP** until it has boiled. Quite simply here we continuously check to see if the kettle has boiled. This loops stops us pouring cold water into a cup which is incorrect logic!

Example 4 – *In my game, If I bump a red apple I win. If I bump a green apple I lose.*
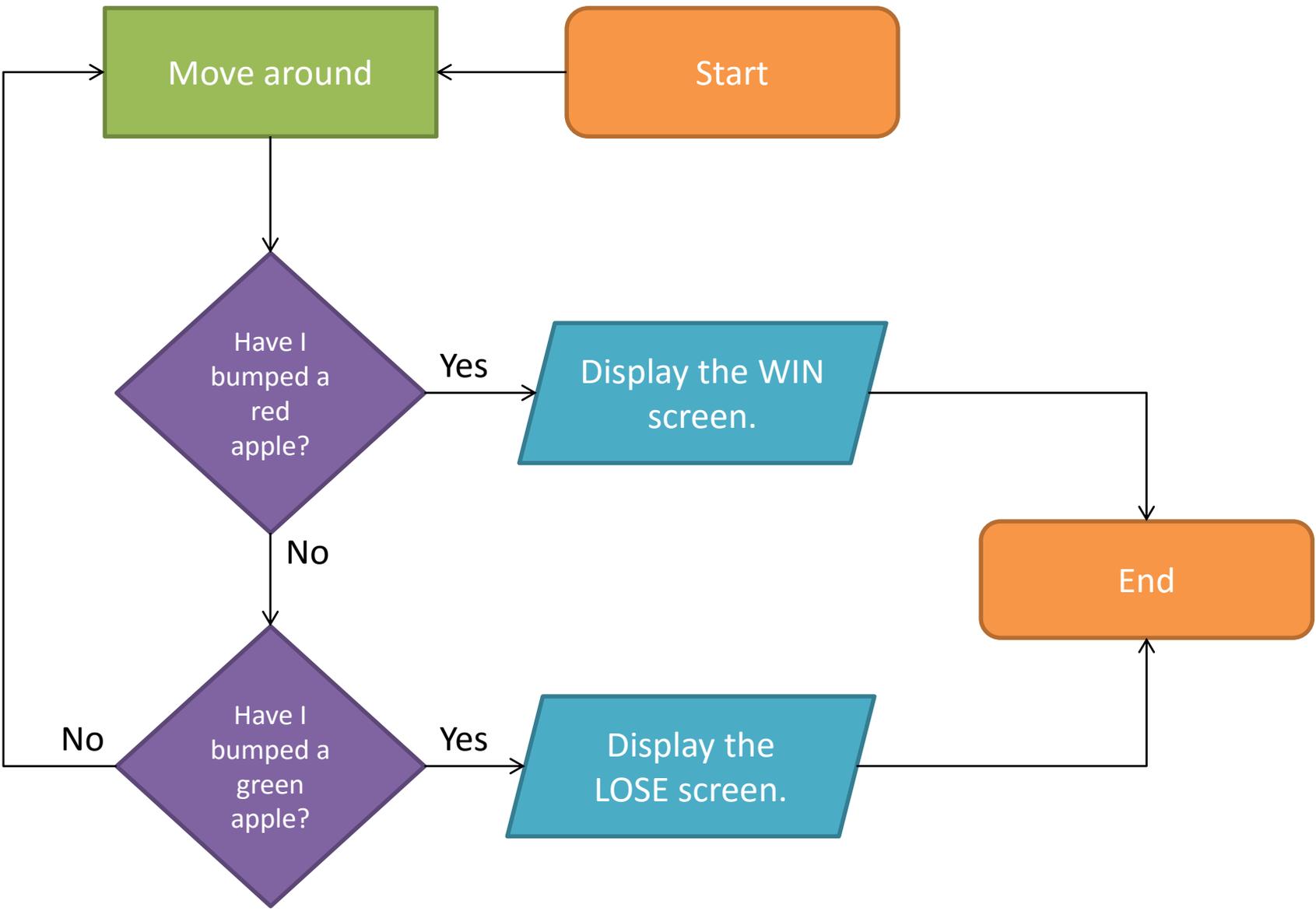
Example 4 – *In my game, If I bump a red apple I win. If I bump a green apple I lose.* **Explained**

```
move  ←——  Start
  │
  ▼
Have I bumped a red apple?  ——Yes——▶  Display the WIN screen.
  │
  No
  │
  ▼
Have I bumped a green apple?  ——Yes——▶
  │
  No
```

First lets check If I have hit a red apple... If I have then I know I win the game. If I have not... then I should check I have not hit a green one instead.

Remember that all routes join back at ONE terminator symbol called "END".

End

So If I have not hit a red apple I might have hit a green one. If I have, then I lose. But if not... then I already know I have not hit a red one, so I should just go back to the part where the player moves around the game... I loop around and keep checking until I have hit an apple!

Have a go...

Try to solve this one on your own:

Create a flowchart that will determine if a car's headlights are on. If they are on, then do nothing. If they are off, then turn them on.

Remember to use the right symbols!

When you have drawn your flowchart, move to the next slide for the answer.

Create a flowchart that will determine if car's headlights are on. If they are on, then do nothing. If they are off, then turn them on. **Solution**
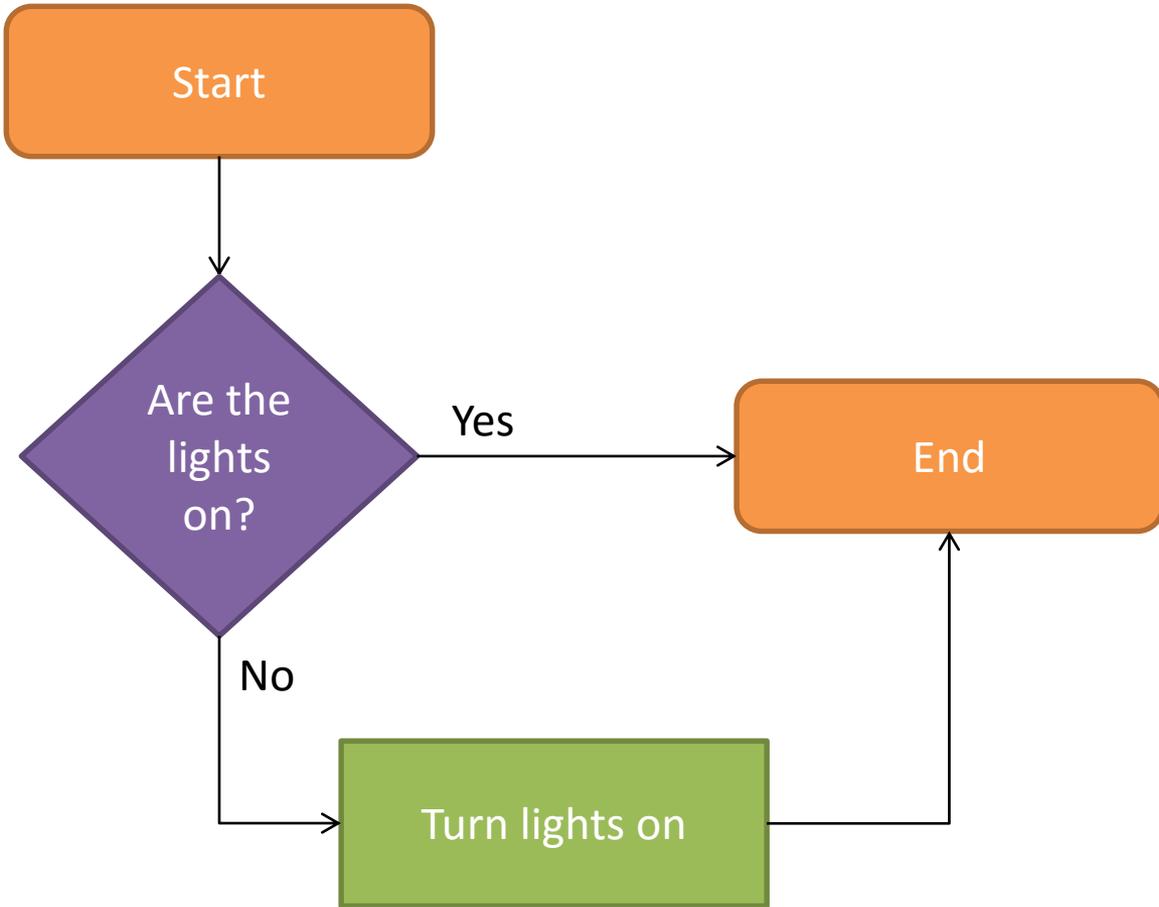
Have a go...

Try to solve this one on your own:

If it is raining outside, then before I leave the house I need to put on my coat and check that I have shut the windows. If they are still open, then close them.

This one is worded differently, but it still asks for you to follow the same sort of process!

When you have drawn your flowchart, move to the next slide for the answer.

If it is raining outside, then before I leave the house I need to put on my coat and check that I have shut the windows. If they are still open, then close them. **Solution**

```
          ┌─────────────┐
          │    Start    │
          └──────┬──────┘
                 │
                 ▼
            ╱─────────╲                              ┌──────────────┐
           ╱  Is it    ╲          Yes                │  Put on coat │
          ╱   raining    ╲────────────────────────▶  └──────┬───────┘
          ╲   outside?   ╱                                  │
           ╲            ╱                                    ▼
            ╲─────────╱                                 ╱─────────╲
                 │                        Yes          ╱  Are the  ╲
                 │ No              ┌────────────────── ╲  windows   ╱
                 │                 │                    ╲  closed?  ╱
                 ▼                 │                     ╲─────────╱
          ┌─────────────┐          │                         │ No
          │     End     │◀─────────┘                         ▼
          └─────────────┘                            ┌──────────────────┐
                                                     │ Close the windows│
                                                     └──────────────────┘
```
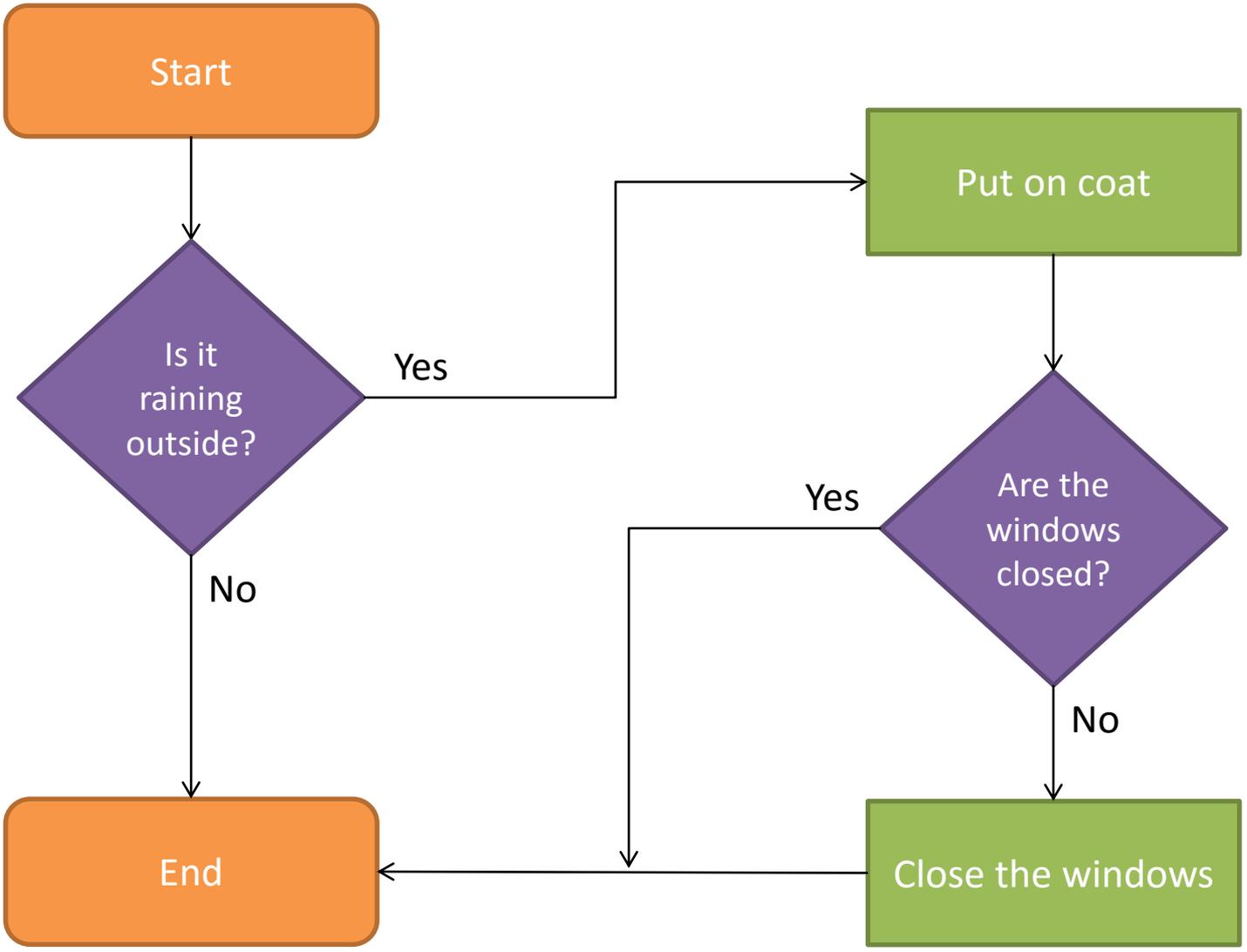
Q&A

Does it matter what colour the shapes are? No, however to make flowcharts more readable normally we make each of the shape types one constant colour, as you have seen in the examples.

I cannot determine which shape to use. This is normally because the process you are trying to represent is too broad and needs to be broken down more. Consider if you can break your current problem down into smaller stages you can represent.

I get confused about how to order things, and when to use loops. Talk the process through to someone else. This other person will not know the flowchart, so will be able to tell you if your logic flows correctly or not. If what you have said does not really make sense or is confusing, then you know to go back and have another look.

Good & Bad practice

Bad Practice

Good Practice

Start with 0 health

Show lose screen and end game.
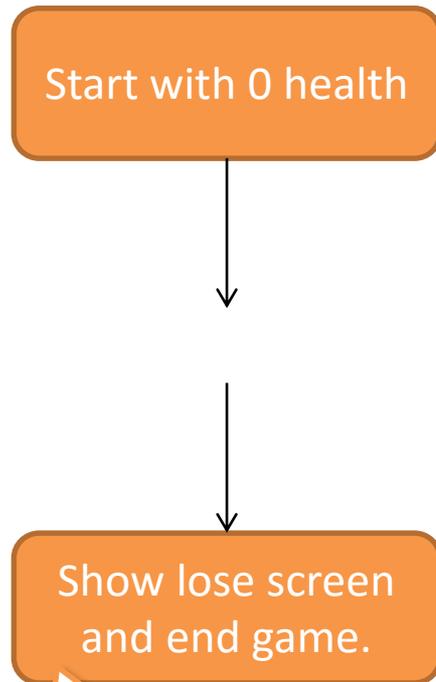
Do not put ANYTHING else inside the terminator shape… put these things in other shapes.

Start

Set health to 0

Display the LOSE screen.

End

# Good & Bad practice

Bad Practice

Move forward and set health to 0, then add 1 point
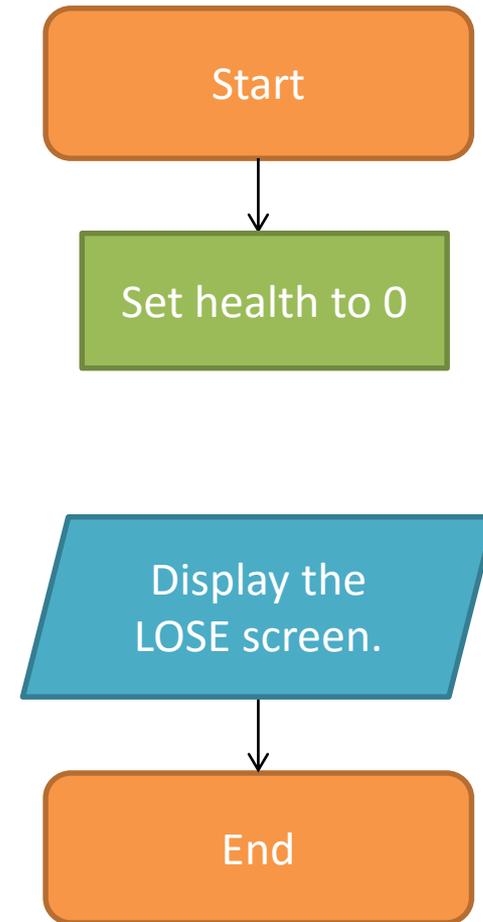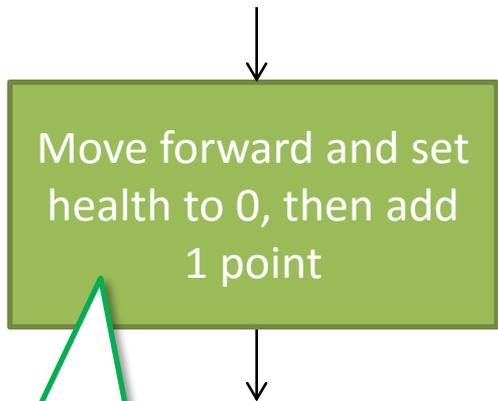
Do not squash multiple instructions into one shape; always split them into separate shapes! Do this even if the same shape is to be used.

Good Practice

Move forward

Set health to 0

Add 1 point

Good & Bad practice

Bad Practice

Good Practice

Move forward

Move forward
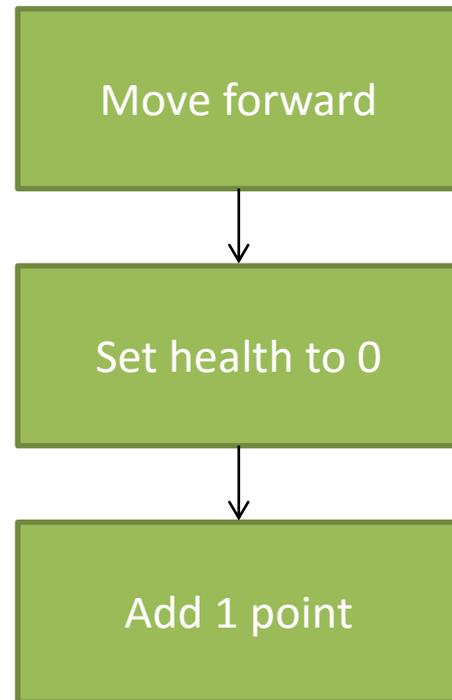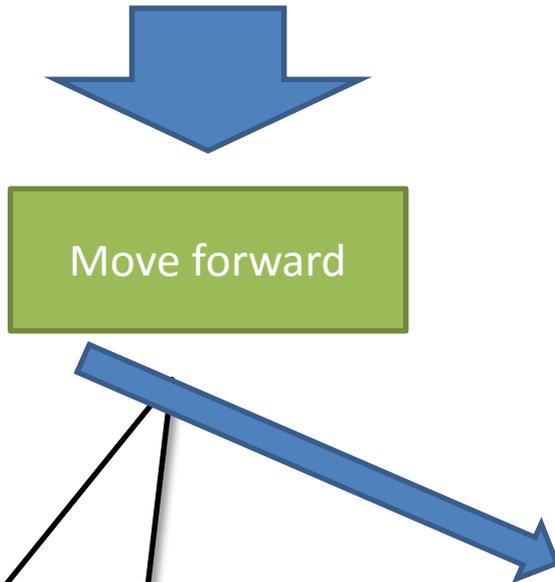
Avoid badly presenting the flowchart. Make sure that you use neat, thin arrows and not huge thick ones, as this makes the logic harder to follow. Ensure that the arrows touch the two shapes they connect.
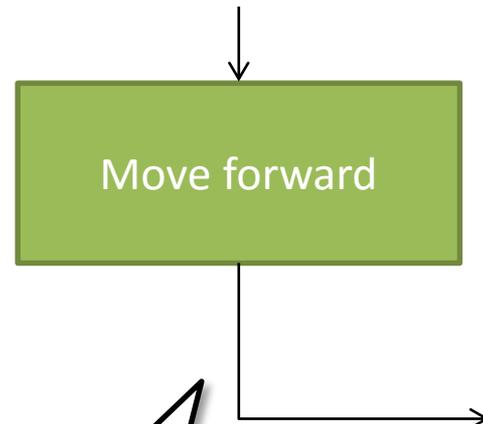
Neat right angled arrows that are single pixel look professional and are easier to follow.

Good & Bad practice

Bad Practice

Good Practice

Is the pencil red?

Is the pencil red?

Yes

No
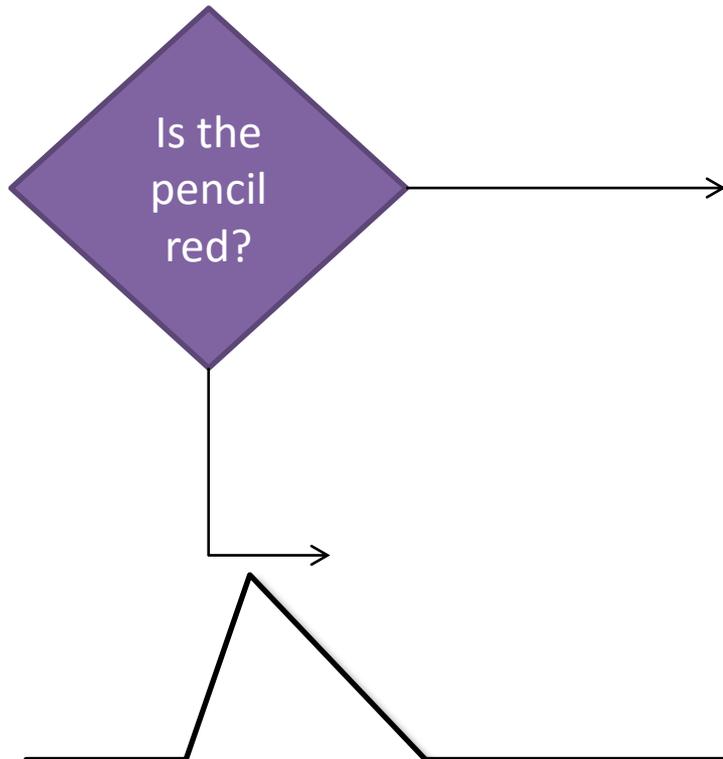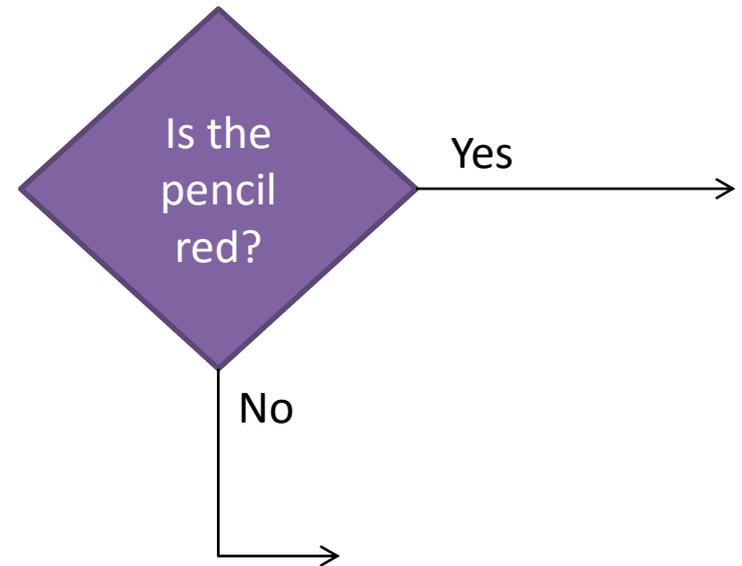
Never leave decisions without labelling the YES and NO lines clearly! Not doing this makes the logic impossible to follow.

Good & Bad practice

Bad Practice

> Move forward

> Set health to 0

> Add 1 point
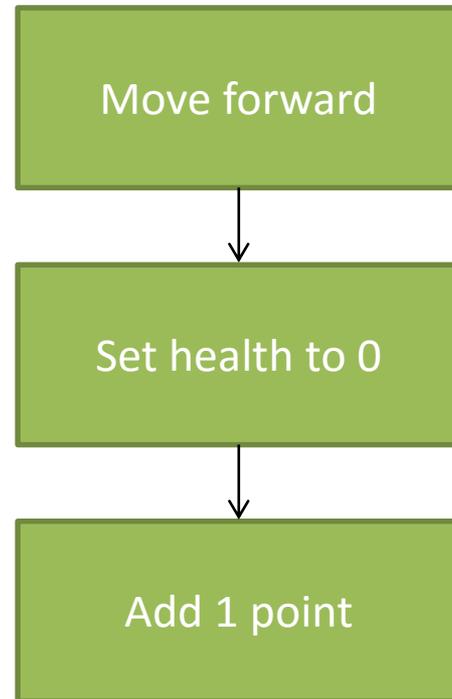
Do not just put in lines... make sure the lines have arrow heads to show direction of logic flow!

Good Practice

> Move forward

> Set health to 0

> Add 1 point

Tips for BEST MARKS!

- ✓ Make sure that the logic flows correctly and you cannot get "stuck" anywhere!

- ✓ Make sure all shapes are used correctly where appropriate.

- ✓ Make the flowchart neat and tidy; with thin arrows that clearly connect to the start and end.

- ✓ Decompose down the problem so it is as specific as possible.