

Conditional Programming with MATLAB

LAB 4

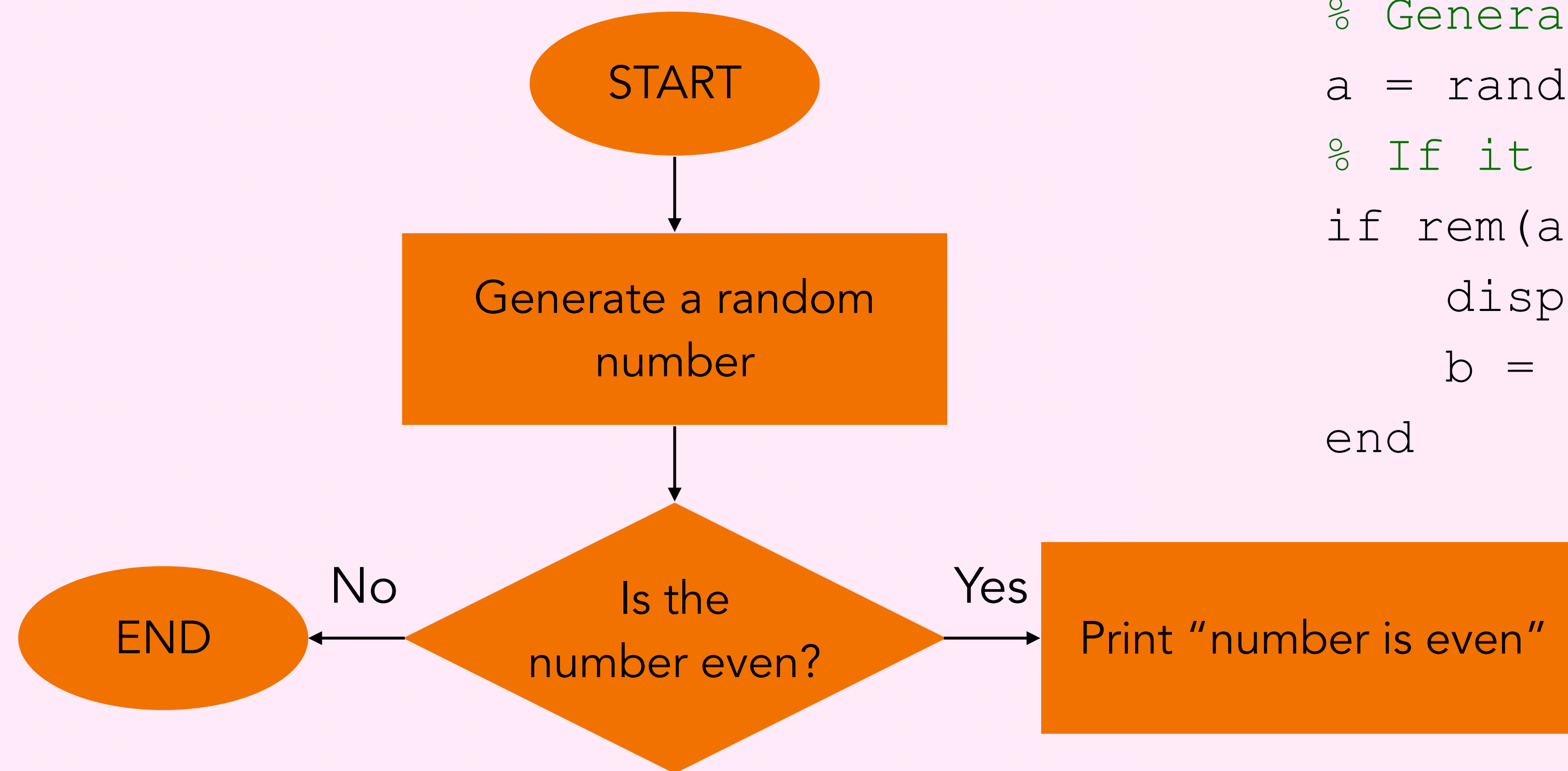
ENGG100 - Spring 2024

Lab 4 Objectives

- To be able to understand conditional programming using MATLAB - including if statements, while loops, and for loops
- Create a script that is converted code from a programming flowchart

Conditional Statements

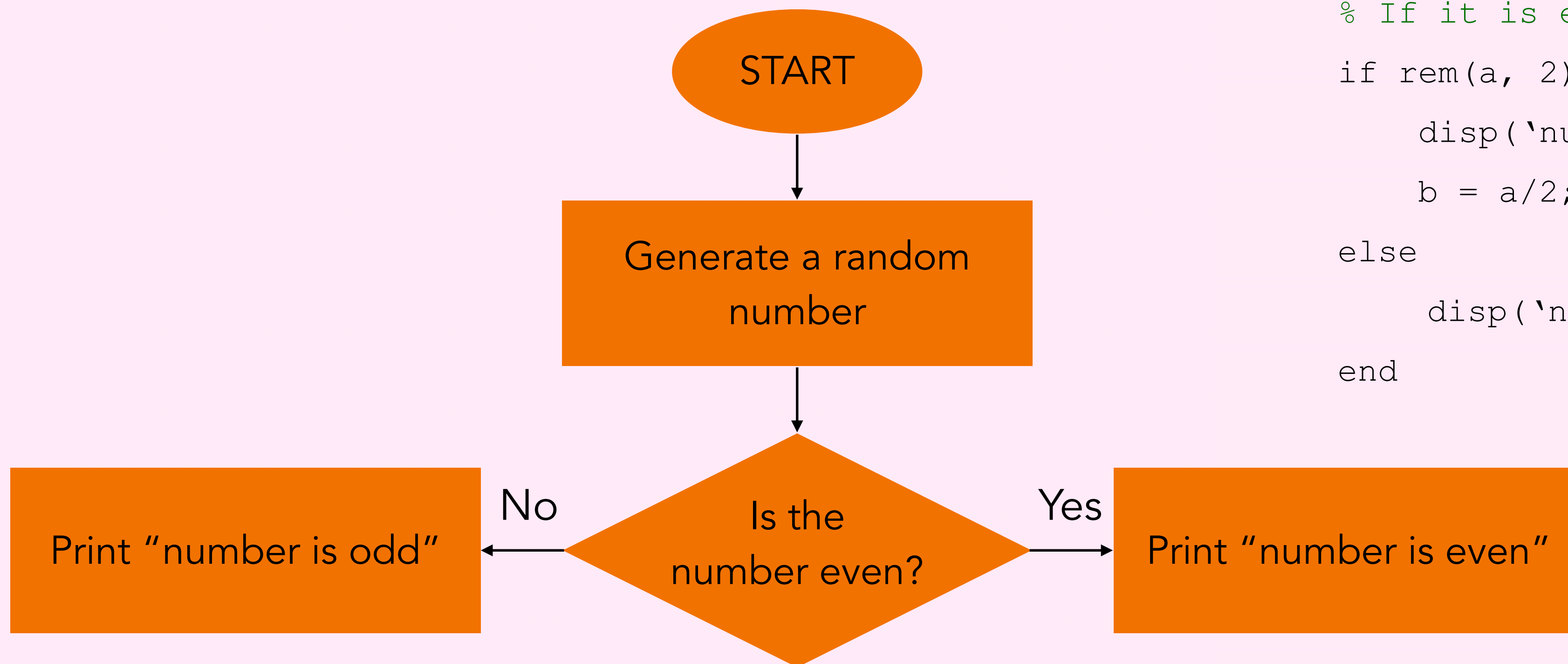
- Conditional statements enable you to select at run-time which block of code to execute. The simplest conditional statement is an `if` statement



```
% Generate a random number
a = randi(100, 1);
% If it is even, divide by 2
if rem(a, 2) == 0
    disp('number is even')
    b = a/2;
end
```

Conditional Statements

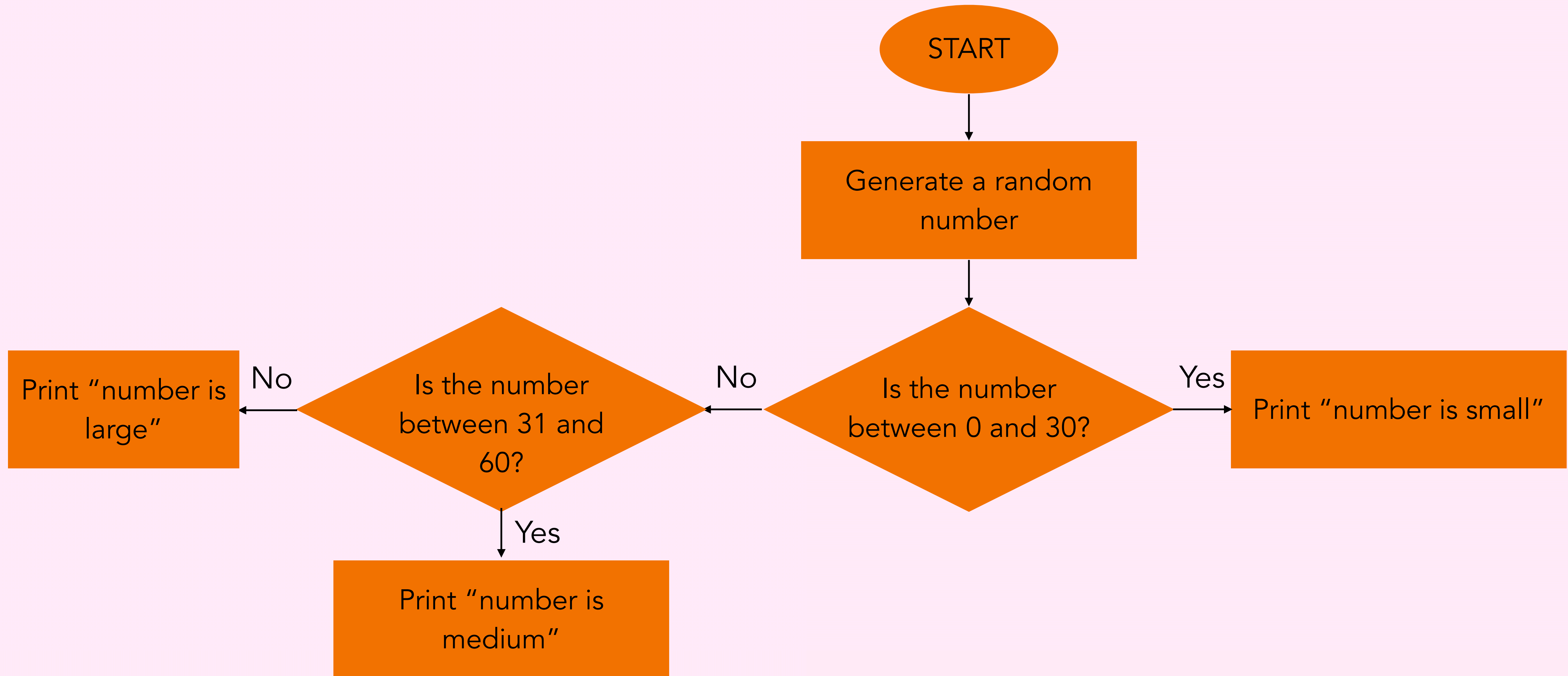
- If statements can include alternate choices, using the optional keywords such as `elseif` or `else`



```
% Generate a random number
a = randi(100, 1);
% If it is even, divide by 2
if rem(a, 2) == 0
    disp('number is even');
    b = a/2;
else
    disp('number is odd');
end
```

Conditional Statements

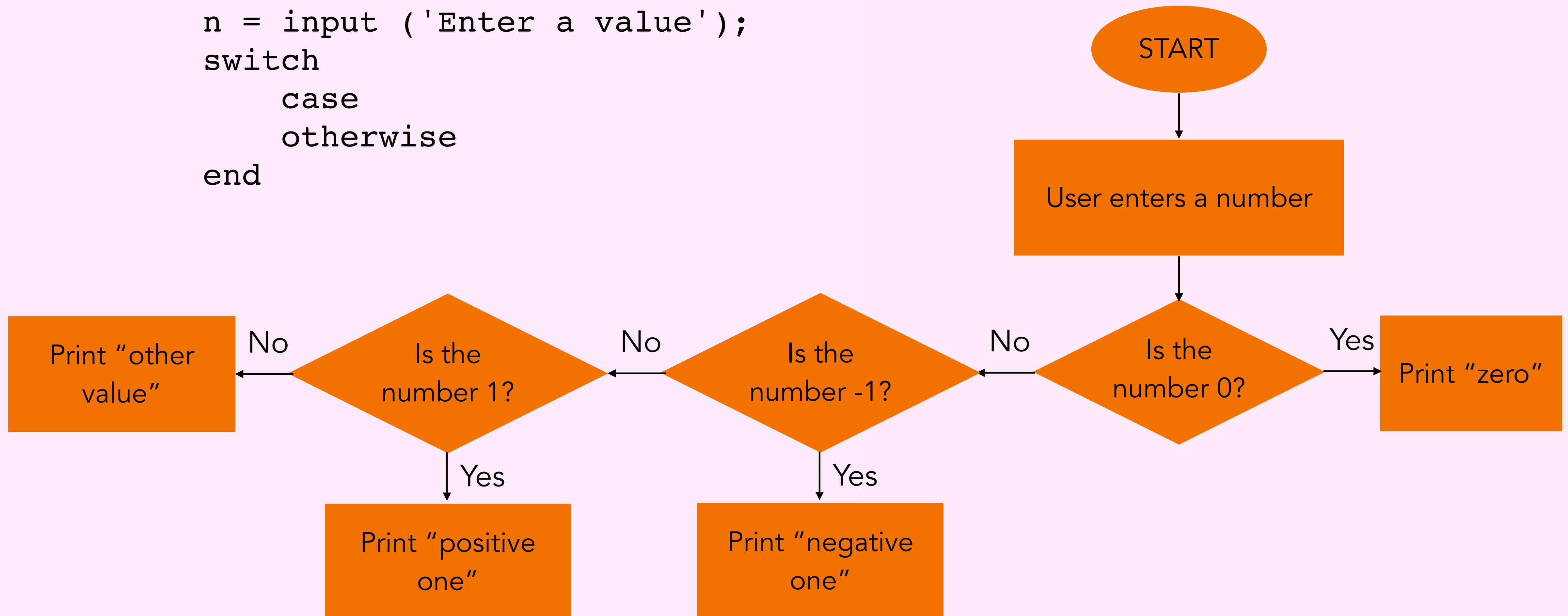
- If statements can include alternate choices, using the optional keywords such as `elseif` or `else`



Conditional Statements

- When you want to test for equality against a set of known values, you can use a switch statement

```
n = input ('Enter a value');  
switch  
    case  
    otherwise  
end
```



TASK 1 - SCRIPT

TEST VALUES:

50, 150, 750, 1500

- In MATLAB create a new script and attempt the below task
- Your script will ask the user for cost of the product from a store and store it in a variable
- Once the cost taken and stored, you will check the cost of the product and assign a discount to the user
 - If the product costs less than 100, calculate a **discount of 5%** on the cost and display the discount value
 - If the product costs between 100 and 500, calculate a **discount of 10%** on the cost and display the discount value
 - If the product costs between 500 and 1000, calculate a **discount of 15%** on the cost and display the discount value
 - If the product costs more than 1000, calculate a discount of 20% on the cost and display the discount value
- **Your script needs to contain:** if and else statements, ANY display function (except disp()) to show the discount values to the user and comments in your code

While Loop

- A while loop is used to repeat a statement while a condition is true.
- Example: Use a while loop to calculate factorial of 10
- A factorial is calculated by **factorial(N)=N x (N-1) x (N-2) x (N-3)**, etc.

```
1  % Create a variable to calculate the factorial of
2  number = 10;
3
4  % Create a variable that will be updated inside the while loop to store the
5  % factorial
6  factorial = number;
7
8  while number > 1
9      number = number - 1;
10     factorial = factorial * number;
11 end
12
13 disp(['n! = ' num2str(factorial)])
```

The diagram illustrates the components of a while loop using arrows from the code to descriptive labels:

- An arrow points from the condition `number > 1` on line 8 to the label **Condition/Expression**.
- An arrow points from the loop body (lines 9-10) to the label **Repeated code block**.
- An arrow points from the `end` keyword on line 11 to the label **Terminate**.

For Loop

- A for loop is used to repeat a statement a certain number of times
- Example: To decrement values, step by increments of -0.2, and display the values. Start from 1 and go down to 0

```
1 ☐ for v = 1.0:-0.2:0.0  
2     disp(v)  
3 end
```

TASK 2 - DRAW.IO & SCRIPT

- Open draw.io on your browser and create a flowchart for **any one of the below processes**. Once done, create a script in MATLAB to convert your flowchart into if & else statements.
 - Statements can either be true or false, so there must be two outputs for a condition block
 - Any repetition will loop on itself using either while or for loop
1. **Getting ready in the morning** – begin with the alarm going off and end with either go to work or go back to sleep. Include at least 2 conditions.
 2. **Answering your phone** – begin with phone rings and end with hanging use. Include at least 2 conditions.
 3. **Answer your emails** – begin with logging on and end with logging off. Include at least 1 condition and 1 repetition.
- **Your report needs to contain:** flowchart with start, end, if conditions and statements, snapshot of your MATLAB code with test results & a copy of your code itself/MATLAB file.

TASK 3 - BONUS (SCRIPT) - optional

- Create a program which calculates the trajectory of a car moving in one direction. The car starts at rest, accelerates at a constant 2 m/s² until it reaches a maximum velocity of 40 m/s, then the script ends.
- The script must store the displacement, velocity and acceleration of the car in separate columns of an array using a time step of 0.1 seconds.
- Tips:
 - Start by initialising the known values at t=0 seconds
 - Include the relevant equations in the blocks in your structure plan (see the table below for equations)
 - Repetition must be used to calculate the next time step based on the information calculated in the previous time step.
 - A condition must be used for the program to terminate when the velocity reaches 40 m/s.

Formula	a	v _f	v _i	d	t
v_f = v_i + at	♦	♦	♦	X	♦
d = v_i t + ½ at²	♦	X	♦	♦	♦
d = v_f t - ½ at²	♦	♦	X	♦	♦
v_f² = v_i² + 2ad	♦	♦	♦	♦	X
d = ½ (v_f + v_i) t	X	♦	♦	♦	♦