

A stylized illustration of a robot wearing a graduation cap and gown, standing in a classroom. The robot is holding a diploma. In the foreground, several students are seated at desks with computers, looking towards the robot. The background shows a city skyline and floating gears.

MAT 275

Generating Powers of 2 Vector Until Threshold in MATLAB

Introduction

This MATLAB script generates a vector containing powers of 2, starting from 2^1 and continuing until the value reaches or exceeds 1000. The script iterates using a while loop to dynamically calculate and append powers of 2 to the vector.

Problem Statement

The objective is to create a script that dynamically generates a vector containing powers of 2 until the value surpasses or equals a specified threshold (1000 in this case).

Solution Steps

- **Initialize Variables:**
 - Declare an empty vector ‘v’.
 - Set initial values for ‘k’ (exponent) and ‘value’.
- **While Loop Iteration:**
 - Utilize a while loop to iteratively calculate powers of 2 and append them to the vector ‘v’.
 - Update ‘k’ and calculate the next value using the formula $2k$.

Pseudo Code

1. Clear the command window. Clear all variables from memory. Clear the current figure window.
2. Initialize an empty vector v .
3. Set the initial value of variable k to 1.
4. Set the initial value of variable $value$ to 1.
5. While the value is less than 1000, repeat the following steps:
 - Append the current value to the vector v .
 - Increment the value of k by 1.
 - Update the value using the formula $value = 2^k$.
6. End the while loop.
7. Output the vector v .

MATLAB Code

```
clc;clf  
clear all
```

```
v=[]; % declaring empty vector
```

```
k=1; % initial value
```

```
value=1; % initial value
```

```
while value<1000
```

```
v=[v,value];
```

```
k=k+1; % update k
```

```
value=2^k; % next value
```

```
end
```

```
v
```

Code Explanation

- **clc; clear all; clf**
 - Clears the command window and clears all variables from the MATLAB workspace also clears the current figure window.
- **v = [];**
 - Initializes an empty vector v.
- **k = 1;**
 - Initializes a variable k to keep track of the exponent.
- **value = 1;**
 - Initializes a variable value with the initial value to be pushed into the vector.

Code Explanation

- **while value < 1000**
 - Executes the loop while the value is less than 1000.
- **v = [v, value];**
 - Appends the current value to the vector v.
- **k = k + 1;**
 - Updates the exponent k for the next iteration.
- **value = 2^k;**
 - Calculates the next value based on the updated exponent.
- **v**
 - Displays the vector v containing powers of 2 until the value reaches or exceeds 1000.

Final Answer

The final output is the vector v containing powers of 2 up to the point where the value reaches or exceeds 1000.

Command Window

$v =$

1 4 8 16 32 64 128 256 512

Additional Comments/Tips

Users can modify the threshold value (1000) to generate powers of 2 until a different limit is reached.

Conclusion

The script demonstrates an effective approach to dynamically generate a vector containing powers of 2 until a specified threshold is met, showcasing MATLAB's flexibility in handling iterative tasks.