Dr.Mahalingam College of Engineering and Technology, Pollachi-642003

Office of Dean Research and Innovation

Report

"MATLAB – Signal and Image Processing Toolbox - Knowledge Sharing Session"

Date: 29 .09.2023

About the Session

The Office Dean Research and Innovation organized a Knowledge Sharing Session for the benefit of the Faculty members of MCET. The session details are given below for your kind reference.

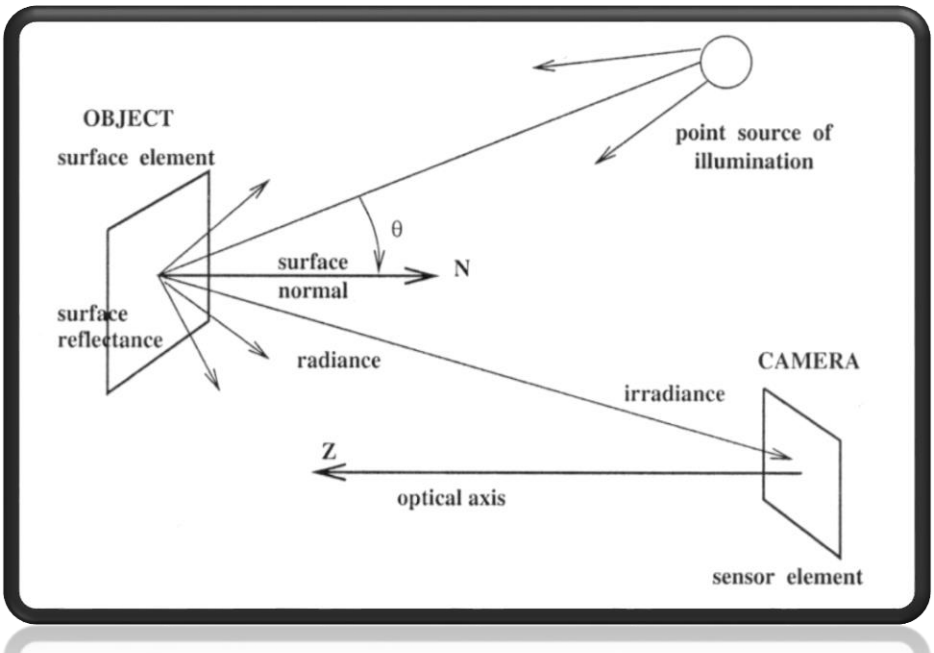
S.No	Name of the Resource Person	Topic	Date &Time	Venue	No of Participants
1	Dr.R.Sudhakar, HoD-ECE	MATLAB – Signal and Image Processing Toolbox	23.09.2023	Programming and IOT Lab(C315)	38

Topics Covered:

Image processing using MATLAB

Image processing involves various techniques and concepts. Image representation refers to the methods used to store and represent images digitally. Visual information is considered more powerful and impactful than textual information. A picture is worth a Thousand words.

Image Formation



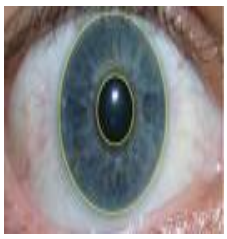
Images in different walks of life

Entertainment


Medical Field


Image

ForensicField

Remote Sensing

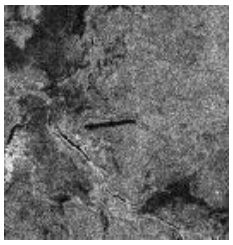



Image Types

- Image: Shades of gray representing light intensity.
- Color Image: Multiple color channels (e.g., RGB) determining pixel color.
- Black and white: Two pixel values (e.g., black and white) for foreground and background.

Resolution

- Spatial Resolution
- Grayscale Resolution

Image Representation of Gray Scale Image

- Gray Scale Image is also called as 2-D matrix
- The Value at (1,1) is top most left corner of an image
- A Values of this 2D matrix can be any integer value from 0 to 255 for 8 bit representation
- The Value “0” corresponds to black
- The Value 255 corresponds to white
- Intermediate values are shades from black to white
- 128x128 image = 128x1128x8 bits=128x128 byt

Image Representation of Color Image

- Color Image=(Red+Green+Blue) Image
- i.e. at each location (x, y), we need to add on more dimension z as (x, y, z) where z = {red, green, blue} by z = {1,2,3}
    - (x, y, 1) --- red component at (x, y)

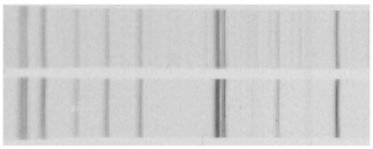
- (x, y, 2) --- green component at (x, y)
- (x, y, 1) --- blue component at (x, y).

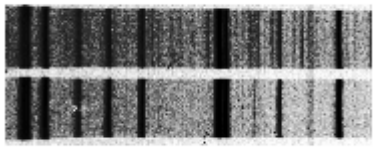
- Color intensity value at the location (1,1)= value at {(1,1,1)+ (1,1,2)+ (1,1,3)}

Image Enhancement

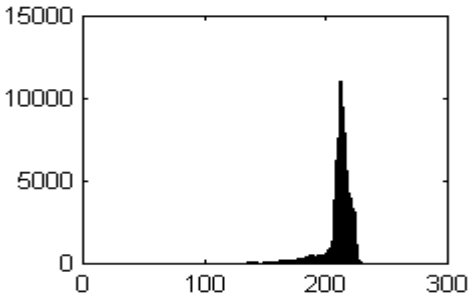
Image enhancement techniques aim to improve the visual quality of an image by adjusting contrast, brightness, or sharpness. Image degradation/restoration focuses on mitigating or reversing the effects of noise, blurring, or other forms of image deterioration.

Original Image

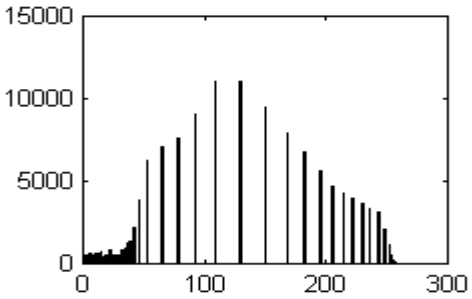




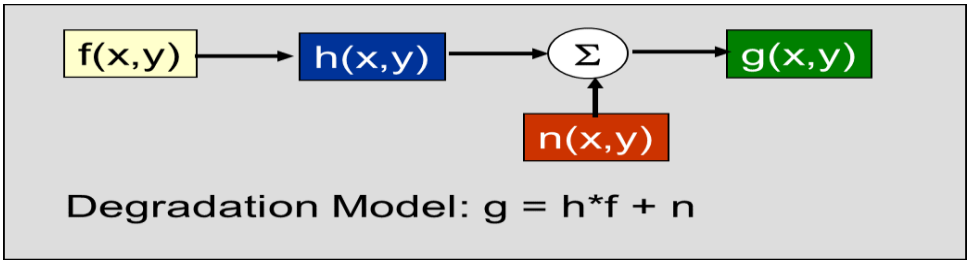
Histogram of Original Image



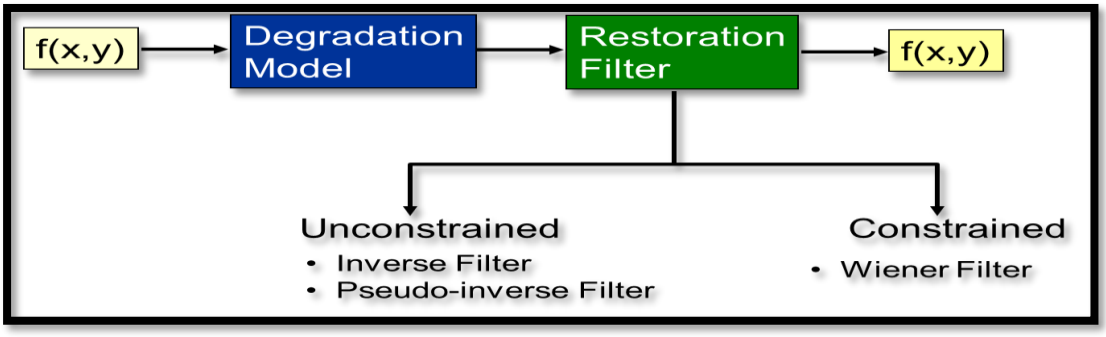
Histogram of Equalized Image



Degradation Model



Restoration Model

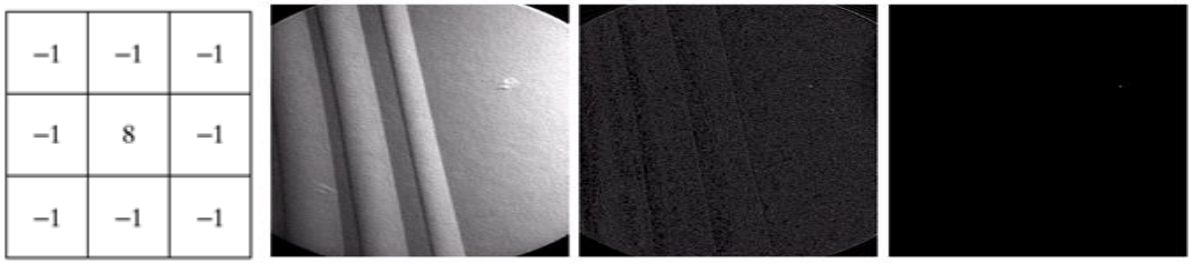


Detection of Discontinuities

- 3 basic types of gray-level discontinuities:
  - Points
  - Lines
  - Edges
- Common method of detection: run a mask through the image.

Image Segmentation

Image segmentation involves dividing an image into meaningful regions or objects.



(a) **(b)** **(c)** **(d)**

a) Point Detection Mask

b) X-ray image of a turbine blade with a porosity

c) Result of point detection

d) Result of using equation

Image Compression

- Since image is represented by huge data storing of images need large memory space.
- This will create problem not only for the storage but also for the processing.
- Hence, reducing the memory size needed to store the image becomes essential. The process known as image compression can achieve this.
- Compression may be lossy of lossless.
- Compression is performed either in spatial domain or in transform domain

Methods for compression

- Predictive coding
- Bit plane encoding
- Transform encoding
- Standards
  - JPEG
  - MPEG

Lossless compression

- There is no information loss, and the image can be reconstructed exactly the same as the original

- Applications: Medical imagery, Archiving

Lossy compression

- Information loss is tolerable
- Many-to-1 mapping in compression eg. quantization
- Applications: commercial distribution (DVD) and rate constrained **environment where lossless** methods cannot provide enough compression ratio

The Image Processing Toolbox

- It is a collection of functions that extend the capability of the MATLAB ® numeric computing environment
- Many of the toolbox functions are MATLAB M-files, series of MATLAB statements that implement specialized image processing algorithms.

Images in the Image Processing Toolbox

- The basic data structure in MATLAB is the array, an ordered set of real or complex elements.
- MATLAB stores most images as two-dimensional arrays (i.e., matrices), in which each element of the matrix corresponds to a single pixel in the displayed image.
- For example, you can select a single pixel from an image matrix using normal matrix subscripting: I(2,15)

Creating a matrix

```
A = [1 2 3;4 5 6;7 8 9];
A = 1     2     3
      4     5     6
      7     8     9
b = [1 2 3 4];
b =    1     2     3     4
c = [1;2;1;-13];

c = 1
2
1
-13
```

Matrix and array operations

```
>> a=[1 2 3]; b=[4 5 6]
>> a+b = [5 7 9]
>>a-b=[-3,-3,-3]
>>a.*b=[4    10    18]
>>a.^ b=[1    32   729]
>>a./b=[0.2500    0.4000    0.5000]
>>a.\b=[4.0000    2.5000    2.0000]
```

Addressing Parts of a Matrix

>> A=diag([1 2 3])

>> A(2,3)=-1

>> A(2,3)

colon operator

>> A(:,1) *(only 1st column,all the elements in the row)*

>> A(2,:)*(only 2nd row, all the elements in the column)*

>> A(:,[1 2])*(two columns)*

>> A(:,1:2:4)*(first and third columns)*

>> A(:) *(appending all the columns into one column)*

Code to Load an Image

>> I=imread('mandrill.bmp','bmp');% load image

Code to Display an Image

>> image(I) % display image

>> whos I

Image conversion

- **gray2ind** - intensity image to index image
- **im2bw** - image to binary
- **im2double** - image to double precision
- **im2uint8** - image to 8-bit unsigned integers
- **im2uint16** - image to 16-bit unsigned integers
- **ind2gray**- indexed image to intensity image
- **mat2gray** - matrix to intensity image
- **rgb2gray** - RGB image to grayscale
- **rgb2ind** - RGB image to indexed image

Histogram Equalization

- Histogram: distribution of intensities

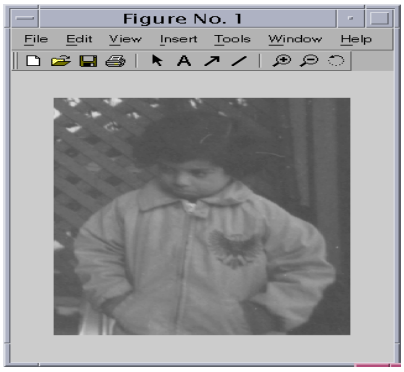
  figure, imhist(I)

- Equalize Image (contrast)

  I2 = histeq(I);

  figure, imshow(I2)

  figure, imhist(I2)



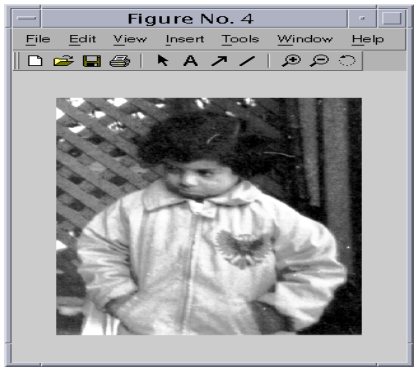


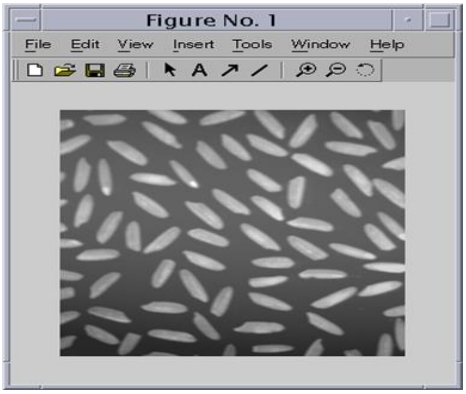
Image enhancement code

- I = imread('pout.tif');
- J = imadjust(I);
- imshow(J)
- figure, imhist(J)

Image Arithmetic code

- imabsdiff
- imadd
- imcomplement
- imdivide
- imlincomb
- immultiply
- **imsubtract**

Example



I = imread('rice.png');

K = imadd(I,J);

imview(K)

Subtracting Image

```
rice2 = imsubtract(rice, background);
```

Multiplying image

```
I = imread('moon.tif');
J = immultiply(I, 1.2);
imshow(I);
figure, imshow(J)
```

Dividing image

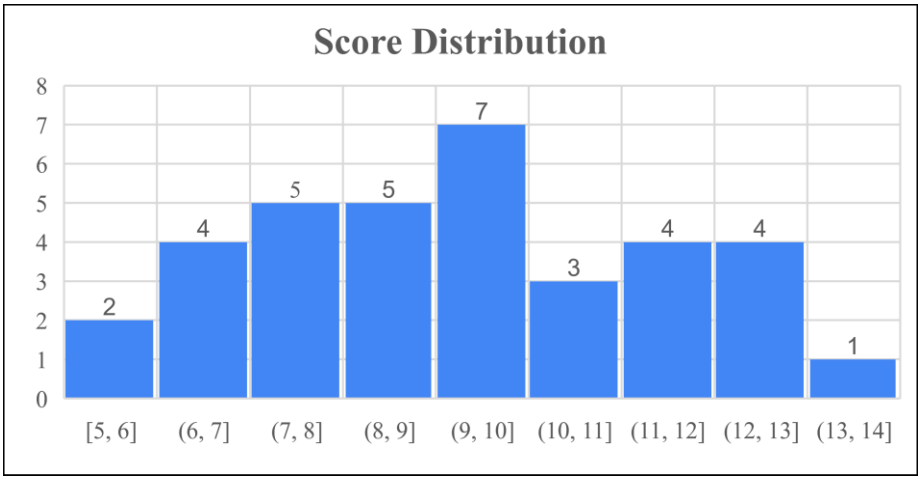
```
I = imread('rice.png');
background = imopen(I, strel('disk', 15));
Ip = imdivide(I, background);
imshow(Ip, [])
```

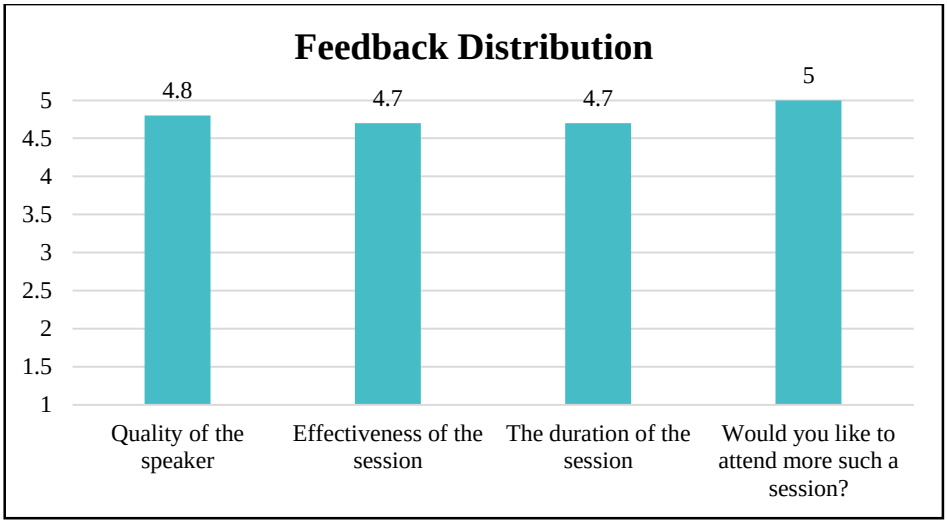
Image Resizing & Rotation

```
I = imread('circuit.tif');
J = imresize(I,1.25);
imshow(I)
figure, imshow(J)
Y = imresize(I,[100 150],'bilinear
J = imrotate(I,35);
I = imread('circuit.tif');
J = imrotate(I,35,'bilinear');
imshow(I)
figure, imshow(J)
```

Feedback and Assessment

Feedback was collected from all participants and they shared positive views about the session. Based on the topic discussed multiple choice questions assessment was given to participants to assess the effectiveness of the session.





1. For A = [1 2 3; 4 5 6; 7 8 9;10 11 12];what is the size of the matrix

a) 3 X 3

b) 5 X5

c) 2 X 2

d) 4 X 3✓

2. The output of A(:,1)

a) only 1st column, all the elements in the row✓

b) only 1st row, all the elements in the column

c) only 1st diagonal values

d) only 1st co diagonal values

3. A(:) implies

a) appending all the columns into one column✓

b) appending all the rows into one column

c)appending all diagonal values

d) appending all the columns into one row

4. The command to remove 2nd row in a matrix is

a) a(:,1)=[ ]

b)a(1,:)=[ ]

c)a(:,2)=[ ]

d) a(2,:)=[ ] ✓

5. Reserved words in 'Matlab' appears in _____ colour

a) yellow color

b).Blue Color✓

c) green color

d)red color

6) If a=[1,2 3 4]; b=2 3 4 5]; N=[a b] what is the size of 'N' matrix

a) 1X 4

b) 2 X4

c) 1 X 8✓

d) 2 X 8

7) Given number A=12.345678901234567, after executing format short, the number of decimal places in the output is _____

a) 5

b) 4✓

c) 8

d) 14

8. The command used to 'display' an image is

a) imshow✓

b)imread

c) iminfo

d) imadd

9. 'histeq' command is used for

a) Histogram doubling

b) Histogram equalization✓

C) Histogram rounding

d) Histogram processing

10. Which of the following process helps in Image enhancement?

a) Digital Image Processing

b) Analog Image Processing

c) Both a and b✓

d) None of the above

11. Which of the following is the first and foremost step in Image Processing?

a) Image acquisition✓

b) Segmentation

c) Image enhancement

d) Image restoration

12. _____ determines the quality of a digital image.

a) The discrete gray levels

b) The number of samples

c) discrete gray levels & number of samples✓

d) None of the mentioned.

13. Which of the following is the abbreviation of JPEG?

a) Joint Photographic Experts Group✓

b) Joint Photographs Expansion Group

c) Joint Photographic Expanded Group

d) Joint Photographic Expansion Group

14. Region of Interest (ROI) operations is generally known as _____

a) Masking✓

b) Dilation

c) Shading correction

d) None of the Mentioned

15. the output of the image after executing the command J = immultiply(I, 1.2);

a) the brightness of the image decreases

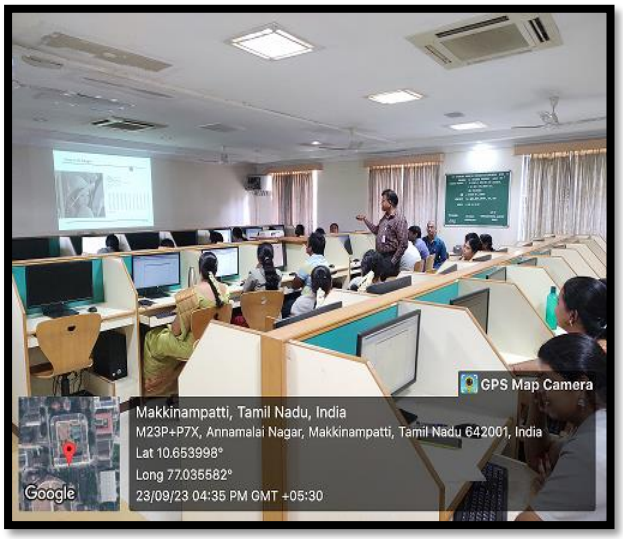
b) the brightness of the image increases✓

c) the darkness of the image increases

d) no change in the brightness

Outcomes

- ❖ As outcomes of the session, participants can understand Basics of Image processing and have an ability to build an application using MATLAB.



Dean R&I

Principal

--Sd--
Secretary

Dr. Mahalingam College of Engineering and Technology, Pollachi - 642003

Office of Dean Research & Innovation

Knowledge Sharing Session - Faculty Attendance

Venue: Program & IoT Project Lab(C315) **Time: 2:30 pm – 4:00 pm** **Date:23.09.2023**

S.No.	Name of the Faculty Members with Designation	Department	Signature
1.	N. SUMATHI AP(SS)	CSE	
2.	C. JAYASHREE, AP(SS)	CSE	
3.	Uma Maheshwari G, AP	CSE	
4.	T. KANNAGI A SARATHY, AP	CSE	23/9/23
5.	S. SENTHIL PRABHU, AP	CSE	23/09/2023
6.	V. ESWARAMURTHY, AP	CSE	23/09/23
7.	C. Jeevanantham	IT	23/9/23
8.	G. Deepa	CSE	
9.	PRABHU K, AP	CSE	
10.	K. Radha	CSE	
11.	S. Devi Lavanya	CSE	23/9/23
12.	J. Santhiya	CSE	23/9/23
13.	D. Gowri	CSE (CYS)	
14.	S. Soundariya,	AP(SS) IT	
15.	A. G. Priya Varshini	IT	
16.	K. Saranya	IT	
17.	G. Sasanya	IT	
18.	T. SUMATHI	IT	
19.	K. Renuka Devi	IT	
20.	M. ARUN	AI & DS	

21.	R. GOVINDARAJ	AP/IT	
22.	M. SAKTHIVADIVEL	AP CSE/CS	
23.	R. PRABHU	AP/IT	R. Prabhu
24.	K.C.THEEPIKA	AP/MCA	Theepika.K.C 23/09/2023.
25.	B. Yesodhai	AP/MCA	B. Yesodhai
26.	A. Suganya	AP/CSE	
27.	T. Selvakumar	AP(SS)/AI&DS	
28.	R. Geetha Rajakumari	AP/AI&DS	
29.	Kiruthikka. D.C	AP/AI&DS	
30.	S. ESTHER NOWROSI	AP/AI&DS	23/9/23
31.	LAVANYA. S.C	AP(SS)/CSE	Lavanya
32.	M. RAJALAKSHMI	AP/AI&DS	M. Rajalakshmi 23/9/23
33.	P. KALAIVANI	AP/IT	
34.	Sudhisrna K-S	AP/IT	Sudhisrna
35.	RAJESWARI. P	AP/IT	Raj 23/09/23
36.	S. NANDHINI	AP/AI&DS	
37.	D. MANOJ KUMAR	AP/CSE	
38.	G. Gayathri	AP/CSE	G. Gayathri
39.			
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