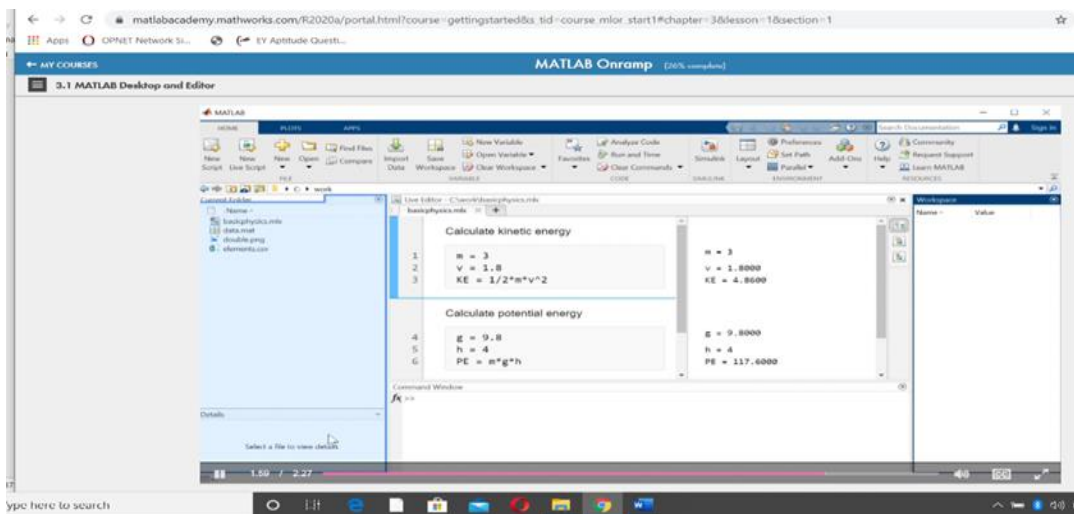


## DAILY ASSESSMENT

<b>Date:</b>	<b>7-7-2020</b>	<b>Name:</b>	<b>Kavyashree m</b>
<b>Course:</b>	<b>Matlab</b>	<b>USN:</b>	<b>4a115ec036</b>
<b>Topic:</b>	<b>Indexing into and modifying arrays, array calculations, calling functions, obtaining help, plotting data, review problems.</b>	<b>Semester &amp; Section:</b>	<b>8<sup>th</sup> A</b>
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### FORENOON SESSION DETAILS



## Matrices and Arrays

Array creation, combining, reshaping, rearranging, and indexing

Matrices and arrays are the fundamental representation of information and data in MATLAB. You can create common arrays and grids, combine existing arrays, manipulate an array's shape and content, and use indexing to access array elements.

## Special Arrays in MATLAB

In this section, we will discuss some functions that create some special arrays. For all these functions, a single argument creates a square array, double arguments create rectangular array.

The zeros() function creates an array of all zeros

For example

```
zeros(5)
```

MATLAB will execute the above statement and return the following result –

ans =

```
0  0  0  0  0
0  0  0  0  0
0  0  0  0  0
0  0  0  0  0
0  0  0  0  0
```

The ones() function creates an array of all ones

For example

```
ones(4,3)
```

MATLAB will execute the above statement and return the following result

ans =

```
1  1  1
1  1  1
1  1  1
1  1  1
```

The eye() function creates an identity matrix.

For example

```
eye(4)
```

MATLAB will execute the above statement and return the following result

ans =

1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

The rand() function creates an array of uniformly distributed random numbers on (0,1)

For example

rand(3, 5)

MATLAB will execute the above statement and return the following result

ans =

0.8147	0.9134	0.2785	0.9649	0.9572
0.9058	0.6324	0.5469	0.1576	0.4854
0.1270	0.0975	0.9575	0.9706	0.8003

## A Magic Square

A magic square is a square that produces the same sum, when its elements are added row-wise, column-wise or diagonally.

The magic() function creates a magic square array. It takes a singular argument that gives the size of the square. The argument must be a scalar greater than or equal to 3.

magic(4)

MATLAB will execute the above statement and return the following result

ans =

16	2	3	13
5	11	10	8
9	7	6	12
4	14	15	1

## Multidimensional Arrays

An array having more than two dimensions is called a multidimensional array in MATLAB. Multidimensional arrays in MATLAB are an extension of the normal two-dimensional matrix.

Generally to generate a multidimensional array, we first create a two-dimensional array and extend it.

For example, let's create a two-dimensional array a.

```
a = [7 9 5; 6 1 9; 4 3 2]
```

MATLAB will execute the above statement and return the following result

```
a =
```

```
7   9   5
6   1   9
4   3   2
```

The array a is a 3-by-3 array; we can add a third dimension to a, by providing the values like –

```
a(:, :, 2) = [ 1 2 3; 4 5 6; 7 8 9]
```

MATLAB will execute the above statement and return the following result

```
a =
```

```
ans(:, :, 1) =
```

```
0   0   0
0   0   0
0   0   0
```

```
ans(:, :, 2) =
```

```
1 2 3
4 5 6
7 8 9
```

We can also create multidimensional arrays using the `ones()`, `zeros()` or the `rand()` functions.

For example,

```
b = rand(4,3,2)
```

MATLAB will execute the above statement and return the following result –

```
b(:,:,1) =
```

```
0.0344  0.7952  0.6463
0.4387  0.1869  0.7094
0.3816  0.4898  0.7547
0.7655  0.4456  0.2760
```

```
b(:,:,2) =
```

```
0.6797  0.4984  0.2238
0.6551  0.9597  0.7513
0.1626  0.3404  0.2551
0.1190  0.5853  0.5060
```

We can also use the `cat()` function to build multidimensional arrays. It concatenates a list of arrays along a specified dimension

Syntax for the `cat()` function is

```
B = cat(dim, A1, A2...)
```

Where,

- B is the new array created
- A1, A2, ... are the arrays to be concatenated

- dim is the dimension along which to concatenate the arrays

### Example

Create a script file and type the following code into it

```
a = [9 8 7; 6 5 4; 3 2 1];  
b = [1 2 3; 4 5 6; 7 8 9];  
c = cat(3, a, b, [ 2 3 1; 4 7 8; 3 9 0])
```

When you run the file, it displays

c(:,:,1) =

```
9   8   7  
6   5   4  
3   2   1
```

c(:,:,2) =

```
1   2   3  
4   5   6  
7   8   9
```

c(:,:,3) =

```
2   3   1  
4   7   8  
3   9   0
```

### Array Functions

MATLAB provides the following functions to sort, rotate, permute, reshape, or shift array contents.

Function	Purpose
length	Length of vector or largest array dimension
ndims	Number of array dimensions

numel	Number of array elements	
size	Array dimensions	
iscolumn	Determines whether input is column vector	
isempty	Determines whether array is empty	
ismatrix	Determines whether input is matrix	
isrow	Determines whether input is row vector	
isscalar	Determines whether input is scalar	
isvector	Determines whether input is vector	
blkdiag	Constructs block diagonal matrix from input arguments	
circshift	Shifts array circularly	
ctranspose	Complex conjugate transpose	
diag	Diagonal matrices and diagonals of matrix	
flipdim	Flips array along specified dimension	
fliplr	Flips matrix from left to right	
flipud	Flips matrix up to down	
ipermute	Inverses permute dimensions of N-D array	
permute	Rearranges dimensions of N-D array	
repmat	Replicates and tile array	

reshape	Reshapes array	
rot90	Rotates matrix 90 degrees	
shiftdim	Shifts dimensions	
issorted	Determines whether set elements are in sorted order	
sort	Sorts array elements in ascending or descending order	
sortrows	Sorts rows in ascending order	
squeeze	Removes singleton dimensions	
transpose	Transpose	
vectorize	Vectorizes expression	

## Examples

The following examples illustrate some of the functions mentioned above.

### Length, Dimension and Number of elements

Create a script file and type the following code into it

```
x = [7.1, 3.4, 7.2, 28/4, 3.6, 17, 9.4, 8.9];
length(x)    % length of x vector
y = rand(3, 4, 5, 2);
ndims(y)     % no of dimensions in array y
s = ['Zara', 'Nuha', 'Shamim', 'Riz', 'Shadab'];
numel(s)     % no of elements in s
```

When you run the file, it displays the following result

```
ans = 8
```

```
ans = 4
```



```
ans = 23
```

### Circular Shifting of the Array Elements

Create a script file and type the following code into it

```
a = [1 2 3; 4 5 6; 7 8 9] % the original array a
b = circshift(a,1)        % circular shift first dimension values down by 1.
c = circshift(a,[1 -1])   % circular shift first dimension values % down by 1
                           % and second dimension values to the left % by 1.
```

When you run the file, it displays the following result

```
a =
```

```
1  2  3
4  5  6
7  8  9
```

```
b =
```

```
7  8  9
1  2  3
4  5  6
```

```
c =
```

```
8  9  7
2  3  1
5  6  4
```

### Sorting Arrays

Create a script file and type the following code into it

```
v = [ 23 45 12 9 5 0 19 17] % horizontal vector
sort(v)                     % sorting v
```

```
m = [2 6 4; 5 3 9; 2 0 1] % two dimensional array
```

```
sort(m, 1) % sorting m along the row
```

```
sort(m, 2) % sorting m along the column
```

When you run the file, it displays the following result

```
v =
```

```
23 45 12 9 5 0 19 17
```

```
ans =
```

```
0 5 9 12 17 19 23 45
```

```
m =
```

```
2 6 4
```

```
5 3 9
```

```
2 0 1
```

```
ans =
```

```
2 0 1
```

```
2 3 4
```

```
5 6 9
```

```
ans =
```

```
2 4 6
```

```
3 5 9
```

```
0 1 2
```

## Cell Array

Cell arrays are arrays of indexed cells where each cell can store an array of a different dimensions and data types.

The cell function is used for creating a cell array.

Syntax for the cell function is

```
C = cell(dim)
```

```
C = cell(dim1,...,dimN)
```

```
D = cell(obj)
```

Where,

- C is the cell array;
- dim is a scalar integer or vector of integers that specifies the dimensions of cell array C;
- dim1, ... , dimN are scalar integers that specify the dimensions of C;
- obj is One of the following
  - Java array or object
  - .NET array of type System.String or System.Object

Example

Create a script file and type the following code into it

```
c = cell(2, 5);
```

```
c = {'Red', 'Blue', 'Green', 'Yellow', 'White'; 1 2 3 4 5}
```

When you run the file, it displays the following result

```
c =
```

```
{
```

```
 [1,1] = Red
```

```
 [2,1] = 1
```

```
 [1,2] = Blue
```

```
 [2,2] = 2
```

```
 [1,3] = Green
```

```
 [2,3] = 3
```

```
 [1,4] = Yellow
```

```
 [2,4] = 4
```

```
 [1,5] = White
```

```
 [2,5] = 5
```

```
}
```

## Accessing Data in Cell Arrays

There are two ways to refer to the elements of a cell array

- Enclosing the indices in first bracket (), to refer to sets of cells
- Enclosing the indices in braces {}, to refer to the data within individual cells

When you enclose the indices in first bracket, it refers to the set of cells.

Cell array indices in smooth parentheses refer to sets of cells.

For example :

```
c = {'Red', 'Blue', 'Green', 'Yellow', 'White'; 1 2 3 4 5};
```

```
c(1:2,1:2)
```

MATLAB will execute the above statement and return the following result

```
ans =
```

```
{
```

```
 [1,1] = Red
```

```
 [2,1] = 1
```

```
 [1,2] = Blue
```

```
 [2,2] = 2
```

```
}
```

You can also access the contents of cells by indexing with curly braces.

For example :

```
c = {'Red', 'Blue', 'Green', 'Yellow', 'White'; 1 2 3 4 5};
```

```
c{1, 2:4}
```

MATLAB will execute the above statement and return the following result

```
ans = Blue
```

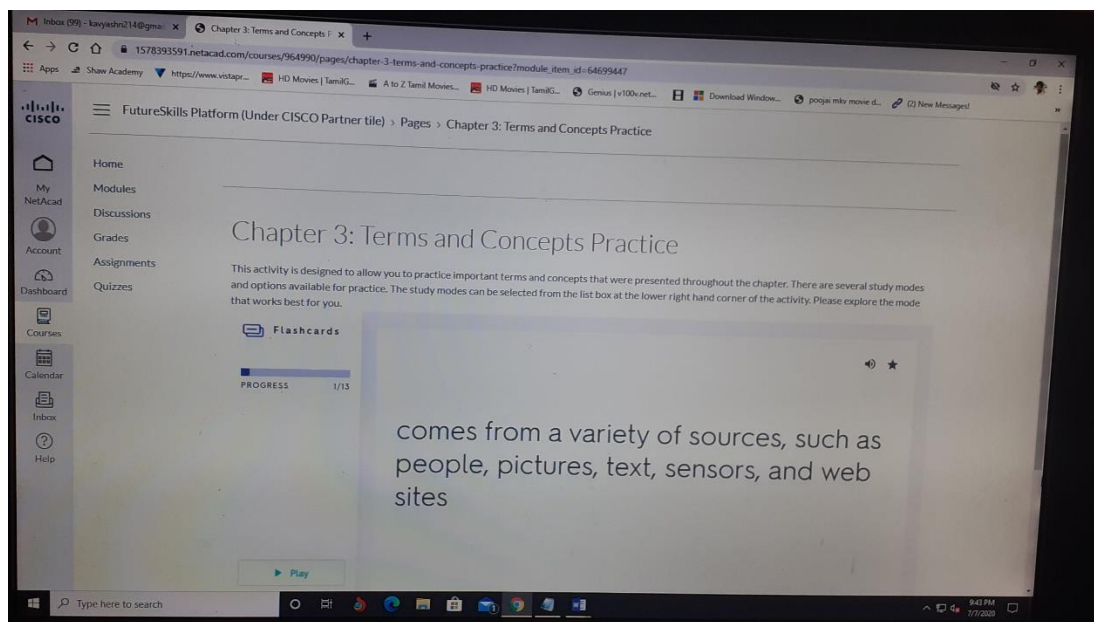
```
ans = Green
```

```
ans = Yellow
```

## AFTERNOON SESSION DETAILS

<b>Date:</b>	<b>7-7-2020</b>	<b>Name:</b>	<b>Kavyashree m</b>
<b>Course:</b>	<b>Cisco certification on IOT</b>	<b>USN:</b>	<b>4a115ec036</b>
<b>Topic:</b>	<b>Chapter 3</b>	<b>Semester &amp; Section:</b>	<b>8<sup>th</sup> A</b>
<b>Github Repository:</b>	<b>kavya</b>		

**Image of session**



### Real-Time Processing of Data for IoT Applications

The internet of things (IoT) is driving value across nearly every sector. Sectors span from manufacturing and logistics to retail and resource management, and the IoT is capturing data from a network of connected “things,” including drones, delivery trucks, medical devices, security cameras, and construction equipment.

While IoT sensors and devices collect tons of valuable insights, they also generate massive, high-speed data streams that are difficult to process, analyze, store, and secure.

IoT data is also highly perishable, and without the right tools, organizations miss opportunities to act on time-sensitive insights with the most potential.

Here, we'll discuss how real-time data analytics and IoT applications come together to create new opportunities across a wide range of sectors.

### **What Does Real-Time Data Processing Mean for IoT Applications?**

As IoT adoption continues to rise, organizations from every sector struggle to keep up with these massive datasets expanding at exponential rates. As a point of reference, IoT devices and sensors can capture gigabytes of data within a few hours—and that's before you consider the data coming from your CRM, social media channels, financial reports, and so on.

At the same time, big data analytics, and AI & machine learning are evolving at a break-neck pace. By applying AI to IoT data management and analytics, organizations can quickly pull valuable information from these massive, heterogeneous data sets and respond to real-time conditions. Together, these technologies are driving game-changing innovations. For example, big data's inherent characteristics (aka the 4Vs) are perfect for “training” AI and ML applications fast.

Those intelligent applications can then be used to automate processes, predict equipment failures, detect security threats—in real-time. In the case of fully-autonomous solutions, AI takes the wheel, relying on a connected network of IoT devices to guide the way.

With significant gains in autonomous driving at all levels, real-time analytics can support drivers with safety features like automatic braking, parking, and collision avoidance by transmitting data.

While there are endless examples of what AI, advanced analytics, and the IoT can accomplish, they can't deliver on those promises without the right tools.

## **Real-Time Insights Depend on Powerful Computing**

Most of the IoT platforms in use today were designed to connect the various devices within a network and merge and process data streams from several heterogeneous sources.

These platforms often address many of the challenges IoT presents like storage, security, and interoperability and can integrate with data analytics solutions to provide valuable business insights. But because most data analytics solutions use a cloud computing architecture called Platform as a Service (PaaS), real-time data processing isn't possible. According to a recent Dell report, using cloud-based systems to process IoT data has several limitations, including security risks, latency, and missed opportunities to act on powerful, real-time insights.

While IoT data streams themselves capture what's happening in-the-moment, processing those data streams means sending them to the cloud for off-line analysis and processing, which can then be reviewed at a later time.

You're also working within a system where you're sending information to a remote location at a volume that may exceed network bandwidth and waste storage space and computing power on unusable insights.

The report found that while just 29% of participating firms have incorporated edge computing into their analytics strategies, 69% of respondents agreed that prioritizing edge for processing IoT data would help them achieve their primary business goals.

However, it's worth noting that edge computing alone won't unlock the door to real-time data analytics.

Technologies like 5G and WiFi6, IoT platforms like Kaa and AWS, event-driven architectures, and analytics tools like Kafka, Kinesis, Spark, Storm, Cassandra, and BigTable, designed for processing continuous streams are converging to enable real-time big data analytics.

## **The Convergence of IoT and Big Data Analytics**

The convergence of IoT, big data, and AI-driven analytics presents a number of new opportunities for companies to create more competitive business models.

According to Forrester's 2020 Predictions, enterprise strategy is becoming a critical initiative for driving digital transformation. While the report mentions that interest in big data has waned over the past few years, innovations in AI and machine learning are driving renewed interest in big data as they present new opportunities to process data and put it to good use.

At the same time, we're seeing more affordable hardware, software, and sensors, as well as emerging standards and best practices driving IoT adoption. As such, there's a rapidly growing number of connected "things" capturing continuous data streams (which includes audio, video, and images) and metrics that measure machine functions, environmental conditions, and more.

Here's a look at some of the ways leading companies are bringing these technologies together to drive value:

- **Disney.** Disney is applying advanced analytics to big IoT data and Machine Learning techniques to create personalized in-park experiences with a wearable, RFID-enabled MagicBand that collects customer traffic patterns provides access to hotel rooms, and enables guests to charge purchases back to their room. Disney's teams can apply these insights to several use cases, including optimized park logistics that reduce long wait times for rides by redirecting guests to less-crowded parts of the park. Additionally, Disney might also use these insights to predict a guest's favorite character and arrange surprise meet-and-greets.
- **CPS Energy.** In an interview with SAS, San Antonio-based CPS Energy discussed how they leverage data analytics to address multiple use cases—from leak detection to helping customers save money. The utility's approach is all about



gathering as much data as possible from smart meters, consumer usage habits, street lights, and more. This combination of event stream data, usage, and real-time anomaly-detection, supports consumers in several ways. For one, the utility can use real-time analytics to detect leaks or outages and address those issues as they emerge. Long-term, CPS can use this massive amount of data to pull the psychological triggers that get customers to embrace energy efficiency initiatives or provide products that help consumers.

- Primex. This example looks at how a company might look toward big data analytics solutions to solve a problem. According to a 2016 SQLStream case study, IoT company, Primex decided to replace its legacy architecture with a more efficient, cloud-based solution. They settled on a serverless architecture that included Amazon Web Services' (AWS) Lambda, Kinesis Streams, and CloudWatch. Initially, this was a practical choice, as they couldn't maintain an open-source platform like Apache Spark. At the time, Primex had over 150k connected devices deployed in the field, which meant they were processing over 67k AWS Lambda requests every five minutes. This system came with several challenges, as it wasn't built to handle data on a massive scale. The report mentions one incident following a four-hour outage where it took 20+ hours for the system to process a massive backlog of sensor data. The organization also incurred high costs (around \$565 a day), latency, and instability.

By moving to SQLStream (a SQL-based platform designed for real-time stream processing), Primex was able to reduce Lambda costs by shifting calculations to SQLStream Blaze; it charges clients a fixed rate as opposed to AWS, which charges by the transaction.

Additionally, the low-latency response times and the ability to ingest and process big data sets underscores the importance of selecting the right architecture to power your solution.

- Alibaba. Alibaba's financial services arm, Ant Financial, uses real-time analytics and data sourced from prior online transactions (think bill-paying history) to evaluate potential borrowers. The Chinese tech giant's real-time credit scoring system allowed small to midsize merchants to apply for microloans and access funds quickly and without collateral.

According to an IFC report, these online solutions allow more small business owners to participate in the economy. Researchers found that 70% of female entrepreneurs have trouble securing loans within the traditional banking system, making it difficult to scale up or weather economic hardship.

### **The Role of Big Data Analytics in IoT**

While the Internet of Things and Big Data are two distinct concepts, they're becoming increasingly interconnected.

In the IoT, you've got a massive network of sensors that collect an unprecedented amount of data from a variety of sources feeding into the broader big data landscape. Here is an example to help you get a better idea of how much data, even one of these devices could collect.

The Oura Ring is a device that is worn on a user's finger and tracks the user's sleep, temperature, and physical activity. The device captures data at a rate of 250 times per second.

To put this in context, if we were to pour water at a rate of a cubic foot per minute into Madison Square Garden, we would fill it in less than 7 hours. That's a lot of data! This data can include things like customer usage insights, sentiment analysis, sales metrics, and behavioral patterns among countless other data sources. Together, Big Data and IoT create contextual insights that can be applied to improve products, services, and processes and in turn, generate more revenue.

Big data analytics platforms hold the key to unlocking this information by taking unstructured IoT data about say, foot traffic at a theme park, weather patterns, or patient health and analyzing that information alongside other data sources to provide a holistic view of the situation. From there, platforms organize that information into digestible insights that companies can use to optimize their processes.

This means that environmental data from sensors, surveillance footage, log files, and geo-location data can join forces with social media and consumer behavior insights, to create a better understanding of your audience bringing them to life in a way that marketing metrics can't provide on their own.

## **How Do IoT and Big Data Impact Each Other?**

According to IDC Group Vice President of IoT, 5G, & Mobility, Carrie MacGillivray, IoT is increasingly driving value creation across both the public and private sectors by enabling the exchange of information between people, processes, and the system of connected “things.”

IoT applications generate raw data from sensors and devices, which is then collected in a centralized repository known as a “data lake.” These data lakes house IoT data alongside structured data such as transaction records and customer profiles and unstructured data from sources like social media, emails, and logs.

Big Data analytics platforms can then be used to generate reports and visualizations from insights sourced from all data sets that feed into that data lake. In turn, it provides a big-picture view of how external factors like market fluctuations, trends, and environmental conditions impact what's happening inside your business.

Additionally, AI-based analytics tools benefit from IoT data, too. By feeding high volume, high variety IoT data into AI applications, you're effectively training those systems to understand and make predictions from real-time data without human intervention which, over time, can improve business outcomes.

## **Deriving Value from IoT Data**

IoT and Big Data analytics are no longer stand-ins representing the promising use cases of tomorrow; they're quickly emerging as essential tools for staying competitive right now. Big IoT data analytics gives organizations the ability to extract value from IoT sensors and systems by analyzing IoT data with existing business tools and third-party data sets to bring more contextual information into the fold. Then, the information can be applied to create better products, services, and experiences. However, organizations need to make sure that they have the infrastructure in place to support real-time data processing—at scale to get the full value from their investments.