# Analytics Circle

## Python Basics

**1) Introduction to Python**
**2) Features and Applications of Python**
**3) Introduction to Anaconda/Jupyter**
**4) Basics of Jupyter**
**5) Defining variables and rules for naming a variable**
**6) Data types in Python**
**7) Types of Operators in Python**
**8) print() method and its arguments**
**9) input() method**
**10) Strings**

- **a)** String indexing
- **b)** String slicing
- **c)** String methods I - upper, lower, title, capitalize
- **d)** String methods II - startswith, ends with, find, index, count
- **e)** String methods III - isupper, islower, isalpha, isdigit, isalnum,
- **f)** String methods IV - join, split, replace
- **g)** String immutability

**11) Conditional Statements**

- **a)** Understanding indentation
- **b)** **f**
- **c)** If-else
- **d)** If-elif
- **e)** If-elif-else
- **f)** Nested if

**12) Loops**

- **a)** What are Iterators/iterables?
- **b)** for loops
- **c)** range function
- **d)** while loops
- **e)** break, continue and pass statements
- **f)** for-else
- **g)** while-else

**13) Pattern based problems**

- **a)** Number patterns
- **b)** Alphabet patterns
- **c)** Shapes patterns
- **d)** Mixed patterns

**14) User Defined function**

- **a)** def keyword
- **b)** creating a function
- **c)** return keyword
- **d)** Function inside a function
- **e)** Recursion
- **f)** *args
- **g)** ** kwargs
- **h)** Practice problems on Functions

**15) List in Python**

- **a)** What is List - Definition and usage
- **b)** List indexing and slicing
- **c)** Mutable Lists
- **d)** Finding min, max and sum for a given list
- **e)** Iteration in Lists using for and while loops
- **f)** List methods I - append, extend, pop, insert
- **g)** List methods II - sort, reverse, clear, remove,
- **h)** List methods III - index, count
- **i)** List comprehension

**16) Tuple in Python**

- **a)** What is Tuple? - Definition and usage
- **b)** Tuple indexing and slicing
- **c)** Immutable Tuple
- **d)** Iteration in Tuple using for and while l
- **e)** Tuple methods - index and count

# Python Basics

## 17) Set in Python

a) What is Set? - Definition and usage
b) Set methods I - union, difference, difference_update
c) Set methods II - intersection, intersection _update
d) Set methods III - discard, remove, pop, add, clear, update
e) Set methods IV - symmetric_ difference, symmetric_difference_ update
f) Set comprehension

## 18) Dictionary in Python

a) What is Dictionary? - Definition and usage
b) Iteration is dictionary using for and while loops
c) Dictionary methods I - keys, values, items
d) Dictionary methods II - get, pop,
e) Dictionary methods III - update, popitem
f) Dictionary comprehension
g) Practice problems on list, tuple, set and dictionary

## 19) Inbuilt functions in Python

a) Enumerate
b) zip
c) map
d) reduce
e) filter
f) lambda function
g) eval

## 20) Using fundamental modules in Python

a) Math module
b) Random module

# Python Advance

## 1) Exception handing

a) Difference between Errors and Exception
b) What is an Exception?
c) Understanding try-except-else blocks of code
d) finally keyword
e) Different types of exceptions
f) Generating and handling exceptions

## 2) File Handling

a) Opening and closing a file
b) Reading .txt files in python
c) Modes of opening a file - read, write, append
d) Writing to a file
e) Understanding file operations - read, readlines, seek, tell
f) Reading .csv file in Python
g) Data Analysis using File handing

## 3) Database connectivity with Sql Server or MongoDb

a) Installing Sql Server or Mongo DB
b) Select statements in SqlServer
c) Understanding Fundamental Sql operations
d) Creating and deleting a database
e) Creating a table
f) Insert, update and Delete operations in Sql
g) Connecting Python with Sql Server / MongoDb
h) Creating connection with Sql server/ Mongo Server using Python
i) Creating cursors in Sql Server
j) Executing CRUD operations using Python for data stored in table/collection

## 4) Advanced Modules

a) Itertools module
   i. Permutations
   ii.Combinations
b) Collections Module - Counter

## 5) DateTime Module in Python

a) Working with date and time
b) Year, Month, Date, day, time functions
c) Hour, minutes, seconds functions
d) Converting strings to date
e) Converting date to strings
f) Calculating difference between two dates

# Python Advance

## 6) Object Oriented Programming

a) Class and Objects

b) Constructor __init__

c) self keyword

d) Variables inside class - Instance and static

e) Types of Methods

i. Instance Methods

ii. Class methods

iii. Static methods

f) Getter and setter methods

g) Understanding Inheritance

h) Types of Inheritance

i. Single Level

ii. Multi Level

iii. Hierarchical

iv. Multiple

i) super method

j) Method Overriding

k) Method Overloading

## 7) Generators and Decorators

a) yield keyword

b) next keyword

c) Understanding Generators

d) Creating decorators with @decorator_name

e) Using *args and **kwargs with decorators.

## 8) GUI in Python - Tkinter

a) Importing Tkinter

b) Understanding Tkinter Geometry

i. Grid

ii. Place

c) Tkinter Widgets I - Labels, Button

d) Event Binding with buttons

e) Tkinter Widgets II - Radiobutton, Checkbox

f) Event Binding with Radiobutton and Checkbox

g) Tkinter Widgets III - Scale, Dropdown

h) Event Binding with Scale and Dropdown

## 9) Common Python based Interview questions

# Data Science

## 1) Statistics

a) What is Statistics?

b) What is Data?

c) Types of data

i. Qualitative Data

ii. Nominal and ordinal Data

iii. Quantitative Data

iv. Discrete and Continuous

d) Population and Sample

e) Measures of Central Tendency

i. Mean

ii. Median

iii. Mode

f) Measure of Dispersion

i. Variance

ii. Standard Deviation

iii. Range

iv. IQR

g) Uni-variate Data Analysis

h) Bi-variate Data Analysis

i. Covariance

ii. Correlation

iii. Difference between Covariance and Correlation

## 2) Numpy

**Numpy Array and fundamental concepts**

a) Numpy Array

b) Array of zeros

c) Array of ones

d) Identity matrix
e) Shape of an array/matrix
f) Changing data type of an array
g) Linear Space and Log Space
h) Methods of Creating Numpy Array
i. np.array()
ii. Converting lists to array
iii. Creating array using arrange() function
i) Reshape function of numpy array
j) Random module in numpy
i. np.random.ranint()
ii. np.random.random()
iii. np.random.rand()
iv. np.random.choice()

## Numpy Indexing and Slicing

a) Numpy indexing
i. Indexing on 1D array
ii. Indexing on 2D array
iii. Indexing on 3D
array b) Numpy slicing
i. Slicing on 1D array
ii. Slicing on 2D array
iii. Slicing on 3D array

## Numpy Array operations

a) Operations on Numpy array
i. Adding scalar value to each and every array value
ii. Adding scalar value row wise
iii. Adding scalar value column wise
iv. Adding array of same dimension
b) Numpy array functions
i. np.sum() - with different axis value
ii. np.max()
iii. np.min()
iv. np.argmin()
v. np.argmax()
vi. np.sort()
vii. np.where()
viii. np.extract()
ix. np.append()
x. np.insert()
xi. np.delete()
c) Adding a new row/column to an array
d) Deleting a row/column from an array
e) Iterating over numpy array using np.nditer
f) Array Flatten
g) Matrix Multiplication
h) Matrix Transpose

## Linear Algebra in Numpy

a) Finding Determinant, and Trace of a Matrix
b) Finding Inverse of a matrix
c) Solving Linear Equations

## 3) Pandas

## Series in pandas

a) Importing pandas
b) What is Series?
c) Creating a Pandas series using
i. Numpy array
ii. List
iii. Tuple
iv. From a column of .csv/.xlsx file table.
d) Series functions
i. Mean and Median
ii. Sum
iii. Count
iv. Cumsum
e) Hoc and loc functions on Series

# Data Science

## DataFrame in Pandas

a) What is DaraFarme?
b) Creating DataFrame using
   i. Series
   ii. Dictionary
   iii. Using lists of lists
c) head, tail, sample functions of dataframe
d) Hoc, loc functions on dataframe
e) Difference between Hoc() and loc()
f) Accessing a particular column/ series inside dataframe
g) Adding a new column/ series to a dataframe
h) Setting index and columns for a dataframe
i) Assigning a column as index
j) Queries in DataFrame
k) Filters in DataFrame
I) Sort index and sort values
m) Finding unique values for a column
n) Pandas describe and info
o) Groupby
p) Data Wrangling
   i. Merge
   ii. Merge with different joins
   iii. Append
   iv. Concat
   v. Apply
   vi. Applymap
   vii. Map
q) Data Cleansing
   i. Removing Nan values
   ii. Fill Nan values
   iii. Renaming columns
   iv. Rearrange all columns
   v. Drop Rows
   vi. Drop Columns
r) Handling DateTime In Pandas

## Pivot table in Pandas

a) Creating pivot table in pandas
b) Stack operations on pivot table
c) Unstack operations on pivot table
d) Levels in stack and unstack

## 4) Matplotlib

a) Importing matplotlib
b) Creating Charts In matplotlib
   i. Bar Chart
   ii. Line Chart
   iii. Pie Chart
   iv. Histogram
   v. Box Plot
   vi. Scatter Chart
   vii. Subplots
c) Understanding intricacies of the above charts

## 5) Sea born

a) Importing seaborn
b) Creating Charts in seaborn
   i. Count Plot
   ii. Violin Plot and Box plot
   iii. Pair Plot
   iv. Strip Plot and Swarm plot
   v. HeatMap
   vi. Joint Plot and Scatterplot

## 6) EDA

a) Exploratory Data Analysis
b) 2-3 Projects on Data Analysis

# Machine Learning

## 1) Introduction

a) What is Machine Learning?
b) Types of Learning
   i. Supervised Learning
   ii. Unsupervised Learning
c) Difference between Supervised and Unsupervised Learning

# Machine Learning

## 2) Data Preprocessing/Feature Engineering

a) Feature Selection method
   i. Correlation
   ii. Heatmap
b) Removing/Replacing Nan values
   i. dropna()
   ii. fillna ()
   iii. replace()
c) Encoding categorical values
   i. Label Encoding
   ii. get_dummies()
   iii. Find and replace
d) Data Scaling
   i. What is scaling?
   ii. Implementing data scaling
e) Splitting dataset into Training and Test sets

## 3) Supervised Learning - Regression

a) What is Supervised Learning?
b) Algorithms in Supervised Learning
c) What is Regression?
d) Regression Metrics
   i. MSE
   ii. MAE
   iii. RMSE
e) Linear Regression
   i. Simple Linear Regression and its implementation
   ii. Multiple Linear Regression and its implementation
   iii. Creating regression models in sklearn
   iv. Making predictions with Regression
   v. SSE, SSR and SST
   vi. R-square coefficient
f) Polynomial Regression and its implementation

## 4) Supervised Learning - Classification

a) What is Classification?
b) Bias and Variance
   i. What is Bias?
   ii. What is Variance?
   iii. Overfitting
   iv. Underfitting
c) Confusion Matrix and its related concepts
   i. What is Confusion Matrix?
   ii. Precision
   iii. Recall
   iv. Accuracy
   v. F-score
   vi. Sensitivity
d) Different Classification algorithms of Supervised Learning
e) Logistic Regression
   i. What is Logistic Regression?
   ii. Working of Logistic Regression
   iii. Sigmoid Function
   iv. Implementation of Logistic Regression
   v. Pros and Cons of Logistic Regression
f) Decision Tree
   i. What is Decision Tree?
   ii. Criteria in Decision Tree
   iii. Implementation of Decision Tree
   iv. Pros and Cons of Decision Tree
g) Random Forest
   i. What is Random Forest?
   ii. Attributes/Parameters of Random Forest
   iii. Difference between Decision Tree and Random Forest
   iv. Concept of Bootstrapping a dataset
   v. Implementation of Random Forest
   vi. Pros and Cons of Random Forest
h) K-NN
   i. What is K-NN?
   ii. K-NN algorithm working
   iii. Method of determining nearest neighbors

# Machine Learning

iv. Implementation of KNN
v. Pros and Cons of K-NN

i) Naïve Bayes
i. What is Naïve Bayes?
ii. Naïve Bayes algorithm working
iii. Implementation of Naïve Bayes
iv. Pros and Cons of Naïve Bayes

## 5) Unsupervised Learning - Clustering

a) What is Unsupervised learning?
b) What is Clustering?
c) Clustering Algorithms
d) K-Means Clustering
i. What is K-means Clustering?
ii. Method to determine optimal number of Clusters - Elbow method
iii. Implementation of K-Means clustering
e) Agglomerative Clustering
i. What is Agglomerative Clustering?
ii. Dendograms
iii. Implementation of Agglomerative

## 6) Unsupervised Learning - Dimensionality Reduction

a) What is dimensionality Reduction
b) Dimensionality Reduction - PCA
i. Working of PCA
ii. Covariance matrix
iii. Eigen value and Eigen vectors
iv. Implementation of PCA

## 7) Projects on ML

a) Projects on Regression, Classification and Clustering

# AI (Deep Learning)

## 1) Difference between ML and AI

## 2) Introduction to Neural Networks

a) What is a Neuron?
b) Working of a Neuron.
c) Perceptron Model
d) Concept of Neuron, Synapse, Weights
e) Concept of Activation Function, Optimizers, Loss Function
f) Equation of a Neural Network

## 3) Introduction to Google Colab

a) Setting up Google colab
b) Uploading files to Google Colab
c) Using Google colab as an alternative to Jupyter Notebook

## 4) Introduction to Tensorflow/Keras

a) Installing Tensorflow
b) Using Tensorflow on Google Colab
c) What is Tensor?
d) Types of Tensors
i. Constants
ii. Variables
e) Indexing and Slicing
f) Tensorflow Operations

## 5) Understanding different Activation Functions

a) Linear
b) Sigmoid
c) Tanh
d) ELU
e) ReLU
f) Leaky Relu

## 6) Understanding different Optimizers

a) Gradient Descent
b) Stochastic Gradient Descent

# AI (Deep Learning)

c) Momentum
d) Adagrad
e) Adam

## 7) Understanding different Loss Functions

a) MSE
b) MAE
c) Binary CrossEntropy

## 8) Tensorflow models

a) Sequential
b) Functional API

## 9) ANN (Artificial Neural Network)

a) ANN for Regression
b) ANN for Classification

## 10) CNN (Convolutional Neural Network)

a) Working of CNN
b) Convolution layer
c) Kernel/filter and strides
d) Pooling Layer
e) Flatten layer
f) Fully Connected Layer
g) Image Classification using CNN
   i. MNIST Image dataset classification
   ii. Fashion MNIST Image dataset classification