S.C.O.D.E.E.N   GLOBAL

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Enterprise Business Integration

Syllabus of Prorgramme

(Python –Data Science–Machine Learning –AI –Web framework Django)

Repository Headlines:

Python + Data science+Machine Learning + Django++BigData+SQL+
UNIX+ETL+BusinessIntelligence + AWS+GIT +Docker +Devops+Agile

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–Shell scripting Domain consultant Insurance /Financial statistics**

Core Python

Introduction to Languages

- ❖ What is Language?
- ❖ Types of languages
- ❖ Introduction to Translators
- ❖ Compiler
- ❖ Interpreter

Introduction to Python

- ❖ What is Python?
- ❖ WHY PYTHON?
- ❖ History
- ❖ Features – Dynamic, Interpreted, Object oriented, Embeddable, Extensible, Large standard libraries, Free and Open source
- ❖ Why Python is General Language?
- ❖ Limitations of Python

Python Software's

- ❖ Python Distributions
- ❖ Download &Python Installation Process in Windows, Unix, Linux and Mac
- ❖ Online Python IDLE
- ❖ Python Real-time IDEs like Spyder, Jupyter Note Book, PyCharm, Different Modes of Python

Python Variables

- ❖ bytes Data Type
- ❖ byte array numpy/array
- ❖ String Formatting in Python
- ❖ Math, Random, Secrets Modules
- ❖ Introduction
- ❖ Initialization of variables
- ❖ Local variables
- ❖ Global variables
- ❖ 'global' keyword
- ❖ Input and Output operations
- ❖ Data conversion functions – int(), float(), complex(), str(), chr(), ord()

Data Structures or Collections

- ❖ Strings, List, Tuple, range

- ❖ Non sequence
- ❖ Set, Frozen set, Dictionary
- ❖ Strings
- ❖ Processing elements using indexing
- ❖ Processing elements using Iterators
- ❖ Manipulation of String using Indexing and Slicing
- ❖ String operators
- ❖ Methods of String object

List Collection

- ❖ List comprehension
- ❖ List indices
- ❖ Processing elements of List through Indexing and Slicing
- ❖ List object methods
- ❖ List is Mutable
- ❖ Mutable and Immutable elements of List
- ❖ Nested Lists
- ❖ List of lists
- ❖ Python Arrays:
- ❖ Case studies

Tuple Collection

- ❖ What is tuple?
- ❖ Tuple is Immutable

Set Collection

- ❖ What is set?
- ❖ Different ways of creating set
- ❖ Difference between list and set
- ❖ Accessing elements of set
- ❖ Python Set Methods
- ❖ Python Set Operations
- ❖ Union of sets
- ❖ functions and methods of set

Dictionary Collection

- ❖ What is dictionary?
- ❖ Difference between list, set and dictionary
- ❖ How to create a dictionary?
- ❖ Accessing values of dictionary

- ❖ Python Dictionary Methods
- ❖ Copying dictionary
- ❖ Updating Dictionary
- ❖ Reading keys from Dictionary
- ❖ Reading values from Dictionary
- ❖ Reading items from Dictionary
- ❖ Delete Keys from the dictionary
- ❖ Sorting the Dictionary
- ❖ Python Dictionary Functions and methods

Operators

- ❖ Arithmetic Operators
- ❖ Comparison Operators
- ❖ Python Assignment Operators
- ❖ Logical Operators
- ❖ Bitwise Operators
- ❖ Shift operators
- ❖ Membership Operators
- ❖ Identity Operators
- ❖ Ternary Operator
- ❖ Operator precedence
- ❖ Difference between "is" vs "=="

Input & Output Operators

- ❖ Print
- ❖ Input
- ❖ Command-line arguments

Control Statements

- ❖ Conditional control statements
- ❖ If
- ❖ If-else
- ❖ If-elif-else
- ❖ Nested-if
- ❖ Loop control statements
- ❖ for
- ❖ while
- ❖ Nested loops
- ❖ Branching statements
- ❖ Break

- ❖ Continue
- ❖ Pass
- ❖ Return
- ❖ Case studies

ZIP

- ❖ zip() in Python
- ❖ How to unzip?

Functions

- ❖ What is Function?
- ❖ Advantages of functions
- ❖ Syntax and Writing function
- ❖ Calling or Invoking function
- ❖ Classification of Functions
- ❖ No arguments and No return values
- ❖ With arguments and No return values
- ❖ With arguments and with return values
- ❖ No arguments and with return values

- ❖ Recursion
- ❖ Python argument type functions:
- ❖ Default argument functions
- ❖ Required (Positional) arguments function
- ❖ Keyword arguments function
- ❖ Variable arguments functions
- ❖ 'pass' keyword in functions
- ❖ Lambda functions/Anonymous functions
- ❖ map ()
- ❖ filter ()
- ❖ reduce ()
- ❖ Nested functions
- ❖ Non local variables, global variables
- ❖ Closures
- ❖ Generators
- ❖ Iterators
- ❖ Monkey patching interview
- ❖ Decorators

Advanced Python

Object Oriented Programming Systems : OOPs

- ❖ Procedural v/s Object oriented programming
- ❖ Principles of OOP – Encapsulation, Abstraction (Data Hiding)
- ❖ Classes and Objects
- ❖ How to define class in python
- ❖ Types of variables – instance variables, class variables.
- ❖ Types of methods – instance methods, class method, static method
- ❖ Object initialization
- ❖ 'self' reference variable
- ❖ 'cls' reference variable
- ❖ AT property class
- ❖ Property () object
- ❖ Creating object properties using setaltr, getaltr functions\

Inner classes

- ❖ Introduction
- ❖ Writing inner class
- ❖ Accessing class level members of inner class
- ❖ Accessing object level members of inner class
- ❖ Local inner classes
- ❖ Complex inner classes

Encapsulation (Data Binding)

- ❖ Access modifiers – private (_), protected (), public
- ❖ Class re-usability
- ❖ Inheritance – single, multi-level, multiple, hierarchical and hybrid inheritance and Diamond inheritance
- ❖ Method resolution order (MRO)
- ❖ super ()
- ❖ Constructors in inheritance
- ❖ Object class
- ❖ Duck typing
- ❖ Concrete Methods in Abstract Base Classes
- ❖ Difference between Abstraction & Encapsulation ---interview question

What is polymorphism

- ❖ Runtime polymorphism
- ❖ Overriding
- ❖ Method overriding
- ❖ Constructor overriding
- ❖ Method overriding in Multiple inheritance and Hybrid Inheritance
- ❖ Overloading
- ❖ Method Overloading
- ❖ Constructor Overloading
- ❖ Operator Overloading

Python Modules

- ❖ Importance of modular programming
- ❖ What is module
- ❖ Types of Modules – Pre defined; User defined.
- ❖ User defined modules creation
- ❖ Functions based modules
- ❖ Class based modules
- ❖ Connecting modules
- ❖ Import module
- ❖ From … import
- ❖ Module alias / Renaming module
- ❖ Built In properties of module
- ❖ Math module,random module

Packages

- ❖ Organizing python project into packages
- ❖ Types of packages – pre defined, user defined.
- ❖ Package v/s Folder
- ❖ .py file
- ❖ Importing package
- ❖ PIP
- ❖ Introduction to PIP
- ❖ Installing PIP
- ❖ Installing Python packages
- ❖ Un installing Python packages

Exception Handling & Types of Errors

- ❖ What is Exception?
- ❖ Why exception handling?
- ❖ Syntax error v/s Runtime error
- ❖ Exception codes – AttributeError, ValueError, IndexError, TypeError…
- ❖ Handling exception – try except block
- ❖ Try with multi except
- ❖ Handling multiple exceptions with single except block
- ❖ Finally block
- ❖ Try-except-finally
- ❖ Try with finally
- ❖ Case study of finally block
- ❖ Raise keyword
- ❖ Custom exceptions / User defined exceptions
- ❖ Need to Custom exceptions
- ❖ Case studies

File &Directory handling

- ❖ Introduction to files
- ❖ Opening file
- ❖ File modes
- ❖ Reading data from file
- ❖ Writing data into file
- ❖ Appending data into file
- ❖ Line count in File
- ❖ CSV module
- ❖ Creating CSV file
- ❖ Reading from CSV file
- ❖ Writing into CSV file

Multi-threading & Multi Processing

- ❖ Introduction
- ❖ Multi tasking v/s Multi threading
- ❖ Threading module
- ❖ Creating thread – inheriting Thread class , Using callable object
- ❖ Life cycle of thread
- ❖ Single threaded application
- ❖ Multi threaded application
- ❖ Can we call run() directly?
- ❖ Need to start() method

- ❖ Sleep()
- ❖ Join()
- ❖ Synchronization – Lock class – acquire(), release() functions

Object serialization – pickle module

- ❖ XML parsing
- ❖ JSON parsing

Python Logging

- ❖ Logging Levels
- ❖ implement Logging
- ❖ Configure Log File in over writing Mode
- ❖ Timestamp in the Log Messages
- ❖ Python Program Exceptions to the Log File
- ❖ Requirement of Our Own Customized Logger
- ❖ Features of Customized Logger

Assertion in Python

- ❖ Types of assertion
- ❖ Simple, Augmented type
- ❖ Use of assertion in real time

OS module

- ❖ Shell script commands
- ❖ Various OS operations in Python
- ❖ Python file system shell methods
- ❖ Creating files and directories
- ❖ Removing files and directories
- ❖ Shutdown and Restart system
- ❖ Renaming files and directories
- ❖ Executing system commands

Garbage collection

- ❖ Introduction
- ❖ Importance of Manual garbage collection
- ❖ Self reference objects garbage collection
- ❖ 'gc' module
- ❖ Collect() method
- ❖ Threshold function
- ❖ Case studies

Database Connection

Python Data Base Communications (PDBC)

- ❖ Introduction to DBMS applications
- ❖ File system v/s DBMS
- ❖ Communicating with MySQL
- ❖ Python – MySQL connector
- ❖ connector module
- ❖ connect () method
- ❖ Oracle Database
- ❖ Install cx_Oracle
- ❖ Cursor Object methods
- ❖ execute () method
- ❖ execute Many () method
- ❖ fetchone()
- ❖ fetchmany()
- ❖ fetchall()
- ❖ Static queries v/s Dynamic queries
- ❖ Transaction management
- ❖ Case studies

********Have a betterluck ********

Data science with Python

3. Python for Data Analysis & Visualization

Numpy

- ❖ Arrays
- ❖ Basic Operations in Numpy
- ❖ Indexing
- ❖ Array Processing

Pandas

- ❖ Series
- ❖ Data Frames
- ❖ Indexing and slicing
- ❖ Groupby
- ❖ Concatenating
- ❖ Merging Joining
- ❖ Missing Values
- ❖ Operations
- ❖ Data Input and Output
- ❖ Pivot
- ❖ Cross tab

Data Visualization

- ❖ Introduction to Matplotlib
- ❖ Line plots
- ❖ Histograms
- ❖ Box and Violin Plots
- ❖ Scatterplot
- ❖ Heatmaps
- ❖ Subplots

- **Visualization with Seaborn**

4. Understanding Text using Python

- **12. Regular Expressions**

- ❖ Literals and Meta Characters

- ❖ How to Regular Expressions using Pandas?
- ❖ Inbuilt Methods
- ❖ Pattern Matching

Projects

- **Data Mining**

This project starts completely from scratch which involves collection of Raw Data from different sources and converting the unstructured data to a structured format to apply Machine Learning and NLP models. This project covers the main four steps of Data Science Life Cycle which involves

- ❖ Data Collection
- ❖ Data Mining
- ❖ Data Preprocessing
- ❖ Data Visualization.
- ❖ Ex: Text, CSV, TSV, Excel Files, Matrices, Images

Statistics - DESCRIPTIVE & INFERENTIAL

Basic Statistics Terminology

- ❖ What is Statistics?
- ❖ How Statistics is used in Data Science
- ❖ What is Probability?
- ❖ Population and Sample
- ❖ Sampling Techniques
- ❖ Convenience Sampling
- ❖ Simple Random Sampling
- ❖ Systematic Random Sampling
- ❖ Stratified Sampling
- ❖ Cluster Sampling

Variables

- ❖ Dependent and Independent Variables
- ❖ Qualitative and Quantitative Data
- ❖ Categorical Data
- ❖ Nominal
- ❖ Ordinal
- ❖ Numerical Data
- ❖ Interval
- ❖ Ratio

❖ Discrete and Continuous Data

Central Tendencies

❖ Mean, Median and Mode
❖ Standard Deviation and Variance
❖ Box Plot and Distribution

Basics of Probability

❖ Probability vs Statistics
❖ Terminology
❖ Probability Rules
❖ Probability Types
❖ Marginal Probability
❖ Joint Probability
❖ Union Probability
❖ Conditional Probability

Probability Theory

❖ Conditional Probability
❖ Bayes Theorem
❖ Confusion Matrix
❖ Z-Score
❖ Histogram

Probability Distribution

❖ Expectation
❖ Variance of Distribution
❖ Skewness
❖ Kurtosis
❖ Discrete Probability Distribution
❖ Bernoulli
❖ Binomial
❖ Geometric
❖ Poison
❖ Continuous Probability Distribution
❖ Exponential
❖ Normal Distribution
❖ Gaussian Distribution
❖ t-Distribution

Confidence Interval

- ❖ Standard Error
- ❖ Margin of Error

Statistical Testing

- ❖ Hypothesis Testing
- ❖ Chi-square test
- ❖ t-test
- ❖ ANOVA

5.MACHINE LEARNING – SUPERVISED LEARNING

1. INTRODUCTION

- ❖ What is Machine Learning?
- ❖ Difference between Supervised Learning and Unsupervised Learning?
- ❖ Difference between Regression and Classification Models?

2. Linear and Multiple Regression

- ❖ Relationship between variables: Regression (Linear, Multivariate Linear Regression) in prediction.
- ❖ Hands on Linear and Multiple Regression using a use case.
- ❖ Understanding the summary output of Linear Regression
- ❖ Residual Analysis
- ❖ Identifying significant features, feature reduction using AIC, multi-collinearity check, observing influential points, etc.
- ❖ Hypothesis testing of Regression Model
- ❖ Confidence intervals of Slope
- ❖ R-square and goodness of fit
- ❖ Influential Observation – Leverage
- ❖ Polynomial Regression
- ❖ Categorical Variable in Regression

3. Logistic Regression

- ❖ **Logistic Regression Intuition**

- ❖ Understanding Logit Function.
- ❖ Hands-on Python Session on Logistic Regression using business case.
- ❖ Measuring the Evaluation Metrics – Confusion Metrics, Accuracy, Precision, recall and ROC Curve.

4. Navie Bayes Classifier

- ❖ Review probability distributions, Joint and conditional probabilities
- ❖ Model Assumptions, Probability estimation
- ❖ Required data processing
- ❖ Feature Selection
- ❖ Classifier

5. Principal Compound Analysis (PCA)

- ❖ Introduction to dimensionality reduction and it's necessity
- ❖ Background: Eigen values, Eigen vectors, Orthogonality
- ❖ Principal components analysis (PCA)
- ❖ Feature Extraction
- ❖ Advantage and application of Dimensionality reduction.

6. Time Series (Forecasting)

- ❖ Trend analysis
- ❖ Cyclical and Seasonal analysis
- ❖ Smoothing; Moving averages; Auto-correlation; ARIMA
- ❖ Application of Time Series in financial markets

7. Decision Tree (Rule – Based)

- ❖ Decision nodes and leaf nodes
- ❖ Variable Selection, Parent and child nodes branching
- ❖ Stopping Criterion
- ❖ Tree pruning and Depth of a tree
- ❖ Overfitting
- ❖ Metrics for decision trees-Gini impurity, Information Gain, Variance Reduction
- ❖ Regression using decision tree
- ❖ Interpretation of a decision tree using If-else
- ❖ Pros and cons of a decision tree
- ❖ Accuracy estimation using cross-validation

8. K-Nearest Neighbor (Distance Based Learning)

- ❖ What is KNN and why do we use it?
- ❖ KNN-algorithm and regression
- ❖ Curse of dimensionality and brief introduction to dimension reduction
- ❖ KNN-outlier treatment and anomaly detection
- ❖ Cross-Validation
- ❖ Pros and cons of KNN

9. Support Vector Machine (Distance Based Learning)

- ❖ Linear learning machines and Kernel space, making kernels and working in feature space
- ❖ Hands on example of SVM classification and regression problems using a business case in Python.

10. Esemble Methods

- ❖ Introduction to Ensemble
- ❖ Bias and Tradeoff
- ❖ Bagging & boosting and its impact on bias and variance
- ❖ Random forest
- ❖ Gradient Boosting
- ❖ XGBoost

Case Studies:

- ❖ Predictive Analytics
- ❖ Banking Use cases – Customer Service prediction,
- ❖ Health care Use cases – Heart Disease, Diabetics
- ❖ Insurance Use cases
- ❖ Telecom Churn Prediction
- ❖ Bike Sharing
- ❖ Air Quality

MACHINE LEARNING – UNSUPERVISED LEARNING

1. Clustering

- ❖ Different clustering methods
- ❖ review of several distance measures
- ❖ Iterative distance-based clustering
- ❖ Dealing with continuous, categorical values in K-Means
- ❖ Constructing a hierarchical cluster, and density-based clustering.
- ❖ Test for stability check of clusters
- ❖ Hands-on implementation of each of these methods in Python

2. Recommendation Systems

- **Association Rules:**
- ❖ How to combine clustering and classification;
- ❖ A mathematical model for association analysis
- ❖ Apriori: Constructs large item sets with mini sup by iterations
- ❖ Metrics of rules-Lift, Support, Confidence, Conviction
- **Recommendation Rules:**
- ❖ Collaborative Filters
- ❖ Content based Learning

Natural Language Processing (NLP) – Text Mining

1. INTRODUCTION

- ❖ What is Text Mining?
- ❖ Libraries
- ❖ NLTK
- ❖ Spacy
- ❖ TextBlob
- ❖ Structured and Unstructured Data
- ❖ Extracting Unstructured text from files and websites

2. Text Preprocessing

- ❖ Regular Expressions for Pattern Matching

- ❖ Text Normalization
- ❖ Text Tokenization
- ❖ Sentence Tokenization
- ❖ Word Tokenization
- ❖ Text Segmentation
- ❖ Stemming
- ❖ Lemmatization

3. Natural Language Understanding (NLP Statistical)

- ❖ Automatic Tagging
- ❖ N-grams Tagging
- ❖ Transformation based Tagging
- ❖ Bag of Words
- ❖ POS Tagging
- ❖ TF – IDF
- ❖ Cosine Similarity
- ❖ Thinking about the math behind text; Properties of words; Vector Space Model
- ❖ Named Entity Recognition
- ❖ Relation Extraction

4. Matrix Factorization

- ❖ Singular Value Decomposition

5. Text Indexing

- ❖ Inverted Indexes
- ❖ Boolean query processing
- ❖ Handling phrase queries, proximity queries
- ❖ Latent Sematic Analysis

6. Text Classification

- • **Case Studies:**
- ❖ Text Mining
- ❖ Sentiment Analysis
- ❖ Spam Detection
- ❖ Dialogue Prediction

9 Artificial Intelligence

1. Introduction to Neural Networks

- ❖ Introduction to Neural Network
- ❖ Introduction to Perceptron
- ❖ Activation Functions
- ❖ Cost Functions
- ❖ Gradient Decent
- ❖ Stochastic Gradient Descent
- ❖ Back propagation

2. Deep Frameworks

- ❖ Installing Tensorflow and Keras
- ❖ Tensorflow and Keras Basic Syntax
- ❖ Tensorflow Graphs
- ❖ Variables and Placeholder
- ❖ Saving and Restoring Models
- ❖ Tensorboard

3. Artificial Neural Network with Tensor flow

- ❖ Neural Network for Regression
- ❖ Neural Network for Classification
- ❖ Evaluating the ANN
- ❖ Improving and tuning the ANN

4. Convolution Neural Networks

- ❖ Convolution Operation
- ❖ ReLU Layer
- ❖ Pooling
- ❖ Flattening
- ❖ Full Connection
- ❖ Softmax and Cross Entropy

5. Building Convolution Neural Network in Python

- ❖ Introduction to Computer Vision
- ❖ OpenCV library in Python
- ❖ Getting Started with Images/Videos

- ❖ Operations on Images
- ❖ Image Processing in OpenCV
- ❖ Geometric Transformation of Images
- ❖ Rotation
- ❖ Affine Transformation
- ❖ Perspective Transformation
- ❖ Imaging Thresholding
- ❖ Contours
- ❖ Edge Detections
- ❖ Morphological Transformation
- ❖ Harris Corner Detection
- ❖ Reshaping Images
- ❖ Normalizing Images
- ❖ Building Convolutional Network with Tensorflow
- ❖ Training CNN for Image Classification

Case Studies:

- ❖ Image Classification

6. Keras (Backend Tensorflow)

- ❖ Keras vs Tensorflow
- ❖ Introduction to Keras
- ❖ Building Artificial Neural Network with Keras
- ❖ Building Convolution Neural Network with Keras

7. Natural Processing Language (Sequential Process)

- ❖ The Idea behind Recurrent Neural Networks
- ❖ Vanishing Gradient Problem
- ❖ LSTM (Long Short-Term Memory)
- ❖ GRU (Gated Recurrent Unit)

Projects

Face Recognition

- ❖ Face Recognition project gives details of the person and can recognize the gender and names. This project involves in
- ❖ Collection of images
- ❖ Preprocessing the data
- ❖ Applying the Model (Machine Learning or Deep Learning)
- ❖ Training and Testing using the model

Ex: Security Unlock, Gender Recognition, Identity Recognition

❖ **Chatbot**

Virtual Assistants are now a common requirement for an Organization. But, to make the assistant more effective we are now into the chatbots which involves Natural Language Process, Deep Learning and Artificial Intelligence. This interactive chatbots are designed to serve as an intellectual responsive process.

Ex: Alexa, Siri, Google Assistant

10 Deployment

❖ Creating pickle and frozen files
❖ Cloud Deploying Machine Learning and Deep Learning model for production

Django Web Framework

❖ **Chapter-1**: Introduction to Web development and Django
❖ **Chapter-2**: Django & Atom Installation and Development of First Web Application
❖ **Chapter-3:**Django Templates and Static Files
❖ **Chapter-4:** Working with Models and Databases
❖ **Chapter-5:**Working with Django Forms
❖ **Chapter-6:**Working with Django Model Forms
❖ **Chapter-7:**Working with Advanced Template Features
❖ **Chapter-8:**Session Management
❖ **Chapter-9:**User Authentication and Authorization
❖ **Chapter-10:**Class Based Views and CRUD Operations by using both CBVs and FBVs
❖ **Chapter-11:**Django ORM
❖ **Chapter-12:**Working with Advanced Model Concepts
❖ **Chapter-13:**Working with Django Middleware
❖ **Chapter-14:**Deployment of our application in the Live Environment
❖ **Chapter-15**: Real Time Project: Blog Application Development
❖ **Chapter-16:**Introduction to Web application Development by using Flask