Week	Contents
1	Introduction to Graphics systems, Basic elements of Computer graphics, Applications of computer graphics.
2	Graphics Hardware: Architecture of Raster and Random scan display devices, input/output devices.
3-4	Drawing Primitives: Raster scan line drawing algorithm, circle and ellipse drawing algorithms
5	Polygon filling, line clipping and polygon clipping algorithms
6	Transformation: 2D and 3D Geometric Transformations
7-9	Viewing : 3D Viewing Transformations, Parallel Projections, Perspective Projections ,Vanishing points
10	Geometric Modeling: Representing curves(Hermite and Bezier)
11-12	Geometric Modeling: Representing curves(Hermite and Bezier)(cont.), Visible Surface determination: Z-buffer algorithm
13	List-priority algorithm and area subdivision algorithm.
14	Surface rendering: Illumination and shading models
15	RGB color model and Computer Animation.

Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

Keywords

Computer Graphics, Modelling, Rendering, Transformation and viewing

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Data Analysis and Visualization (BHCS15A) Discipline Specific Elective - (DSE)

Credit: 06

Course Objective

This course introduces students to data analysis and visualization in the field of exploratory data science using Python.

Course Learning Outcomes

On successful completion of the course, the students will be able to :

1. Use data analysis tools in the pandas library.
2. Load, clean, transform, merge and reshape data.
3. Create informative visualization and summarize data sets.
4. Analyze and manipulate time series data.
5. Solve real world data analysis problems.

Detailed Syllabus

Unit 1

Introduction: Introduction to Data Science, Exploratory Data Analysis and Data Science Process. Motivation for using Python for Data Analysis, Introduction of Python shell iPython and Jupyter Notebook.

Essential Python Libraries: NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels

Unit 2

Getting Started with Pandas: Arrays and vectorized conputation, Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics.

Data Loading, Storage and File Formats.

Reading and Writing Data in Text Format, Web Scraping, Binary Data Formats, Interacting with Web APIs, Interacting with Databases

Data Cleaning and Preparation.

Handling Missing Data, Data Transformation, String Manipulation

Unit 3

Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting.

Data Visualization matplotlib: Basics of matplotlib, plotting with pandas and seaborn, other python visualization tools

Unit 4

Data Aggregation and Group operations: Group by Mechanics, Data aggregation, General split-apply-combine, Pivot tables and cross tabulation

Time Series Data Analysis: Date and Time Data Types and Tools, Time series Basics, date Ranges, Frequencies and Shifting, Time Zone Handling, Periods and Periods Arithmetic, Resampling and Frequency conversion, Moving Window Functions.

Unit 5

Advanced Pandas: Categorical Data, Advanced GroupBy Use, Techniques for Method Chaining

Practical

Use data set of your choice from Open Data Portal (https://data.gov.in/) for the following exercises.

1. Practicals based on NumPy ndarray
2. Practicals based on Pandas Data Structures
3. Practicals based on Data Loading, Storage and File Formats
4. Practicals based on Interacting with Web APIs
5. Practicals based on Data Cleaning and Preparation
6. Practicals based on Data Wrangling
7. Practicals based on Data Visualization using matplotlib
8. Practicals based on Data Aggregation
9. Practicals based on Time Series Data Analysis

References

1. McKinney, W.(2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython*. 2nd edition. O'Reilly Media.

2. O'Neil, C., & Schutt, R. (2013). *Doing Data Science: Straight Talk from the Frontline* O'Reilly Media.

Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Content
1	Introduction: What is Data Science? Exploratory Data Analysis and Data Science Process. Why Python for Data Analysis? Introduction of Python shell iPython and

	Jupyter Notebook.
2-3	Essential Python Libraries: Learn NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels.
4	Built-in Data Structures, Function and Files: Data Structure and sequences, Functions, Files and Operating systems
5	Arrays and Vectorized computation: The NumPy ndarray, Universal Functions, Array Oriented Programming with Arrays, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation
6	Getting Started with pandas: Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics.
7	Data Loading, Storage and File Formats: Reading and Writing Data in Text Format, Web Scraping, Binary Data Formats, Interacting with Web APIs, Interacting with Databases.
8	Data Cleaning and Preparation: Handling Missing Data, Data Transformation, String Manipulation
9	Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting.
10	Data Visualization matplotlib: Basics of matplotlib, plotting with pandas and seaborn, other python visualization tools.
11	Data Aggregation and Group operations: Group by Mechanics, Data aggregation, General split-apply-combine, Pivot tables and cross tabulation
12-13	Time Series Data Analysis: Date and Time Data Types and Tools, Time series Basics, date Ranges, Frequencies and Shifting, Time Zone Handling, Periods and Periods Arithmetic, Resampling and Frequency conversion, Moving Window Functions
14-15	Data Analysis Case Studies

Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

Keywords

Data Analysis, data wrangling, data visualization, data cleaning, data preparation

System Programming (BHCS15B) Discipline Specific Elective - (DSE)

Credit: 06

Course Objective

The course is focused on design of assembler and basic compiler. The course covers topics like absolute loader, relocating loader and dynamic linking.

Course Learning Outcomes

On successful completion of the course, the students will be able to:

1. Describe the working of assemblers and compilers.
2. Use Lex/ Yacc for building basic compiler.
3. Develop a two pass Assemblers.
4. Describe the role of the loaders, linkers and relocatable programs.

Detailed Syllabus

Unit 1

Assemblers & Loaders, Linkers: One pass and two pass assembler, design of an assembler, Absolute loader, relocation and linking concepts, relocating loader and Dynamic Linking.

Unit 2

Introduction: Overview of compilation, Phases of a compiler.

Unit 3

Lexical Analysis: Role of a Lexical analyzer, Specification and recognition of tokens, Symbol table, lexical Analyzer Generator.

Unit 4

Parsing & Intermediate representations: Bottom up parsing- LR parser, yacc,three address code generation, syntax directed translation, translation of types, control statements

Unit 5

Storage organization & Code generation: Activation records, stack allocation, Object code generation