

The Networking Academy Learning Portfolio

 Aligns to Certification

 Instructor Training required

 Self-paced

* Available within 12 months

Collaborate for Impact




 **Introduction to Packet Tracer** Packet Tracer Hackathons Prototyping Lab Internships





Exploratory

Foundational

Career-Ready

 Networking

 **Networking Essentials**
 **Mobility Fundamentals**
 **Emerging Tech Workshop: Network Programmability Using Cisco APIC-EM**

  **CCNA R&S: Introduction to Networks, R&S Essentials, Scaling Networks, Connecting Networks**
  **CCNP R&S: Switch, Route, TShoot**

 Security

 **Introduction to Cybersecurity**

 **Cybersecurity Essentials**

 **CCNA Security**
 **CCNA Cybersecurity Operations**

 IoT & Analytics

 **Introduction to IoT**

IoT Fundamentals:
 Connecting Things, **Big Data & Analytics**, IoT Security
 Hackathon Playbook



 OS & IT



 **NDG Linux Unhatched**

  **NDG Linux Essentials**
  **IT Essentials**

 **NDG Linux I**
 **NDG Linux II**

 Programming

 **CLA: Programming Essentials in C**
 **CPA: Programming Essentials in C++**
 **PCAP: Programming Essentials in Python**
 **Emerging Tech Workshop: Experimenting with REST APIs using WebEx Teams**

 **CLP: Advanced Programming in C**
 **CPP: Advanced Programming in C++**

 Business

 **Be Your Own Boss**

 **Entrepreneurship**

 Digital Literacy

 **Get Connected**

IoT Fundamentals Curriculum

Overview

IoT Fundamentals is a **multi-disciplinary hands-on curriculum** teaching **how to ideate, prototype and articulate the business value of an “end-to-end IoT Solution”**.

A Multidisciplinary Digital Foundation

IoT Fundamentals



Electronics
Programming
Networking
Data Analytics
Cybersecurity

Business Acumen
Complex Problem solving
Design thinking
Soft Skills

Career Prep

The curriculum provides a strong skills and design-thinking foundation for IoT job families that exist today and in the future.

The skills developed in the curriculum is the starting point to prepare for **employer-validated** jobs like:

- IoT Device Management
- IoT Product Manager
- IoT Data Analytics

Learning Components

- Connecting Things course
- **Big Data & Analytics course**
- Security course
- Hackathon Playbook
- Cisco Prototyping Lab
- Cisco Packet Tracer (PT 7.1)

Big Data & Analytics 2.01

Course Info

Target Audience:

2 and 4-year College students
4-Year University students

Pre-req.: IoTf Connecting Things

Languages: English, Spanish, Chinese, French

Course Delivery: Instructor-led

Estimated Time to Complete:

40-50 hours

Recommended next course:

IoTf: Security

IoTf: Hackathon Playbook

Instructor Training: Required

Course Overview

Students will learn how to use Python data libraries to create a pipeline that **acquires**, **transforms** and **visualizes** data collected from IoT sensors and machines. They will also learn how to use data analytics and Machine Learning to extract **new knowledge** from the acquired data.

- 6 Chapters
- 11 labs, 14 Interactive activities
- 18 PL-App Jupyter notebooks (Python)

Benefits

The transformative element of any IoT system is the data that can be collected from it. Thus the ability to extract data and **use data analytics techniques to gain insights** increases employability.

Cisco Prototyping Lab

All courses in the IoT Fundamentals curriculum use the [Cisco Prototyping Lab](#) as the basis for their hands-on experience. The Prototyping Lab is a set of hardware and software components that enables students and instructors to learn about, to prototype, and to model various IoT, digitization and data analytics solutions. The two main components of the Prototyping Lab are:

Prototyping Lab Kit (PL-Kit)

The hardware components are part of the Prototyping Lab Kit (PL-Kit). The PL-Kit is based on Open HW prototyping boards such as Raspberry Pi and Arduino and includes additional sensors, actuators, and electronic components. The PL-Kit can be used to build sophisticated prototypes of end to end IoT systems that can sense and actuate the real physical world, analyze and process the data at the fog layer, and connect to network and cloud systems.

Prototyping Lab App (PL-App)

The primary software component of the Prototyping Lab is the Prototyping Lab App (PL-App). The PL-App is a software platform running on a Raspberry Pi that exposes a web interface based on a concept of notebooks.

Notebook concept

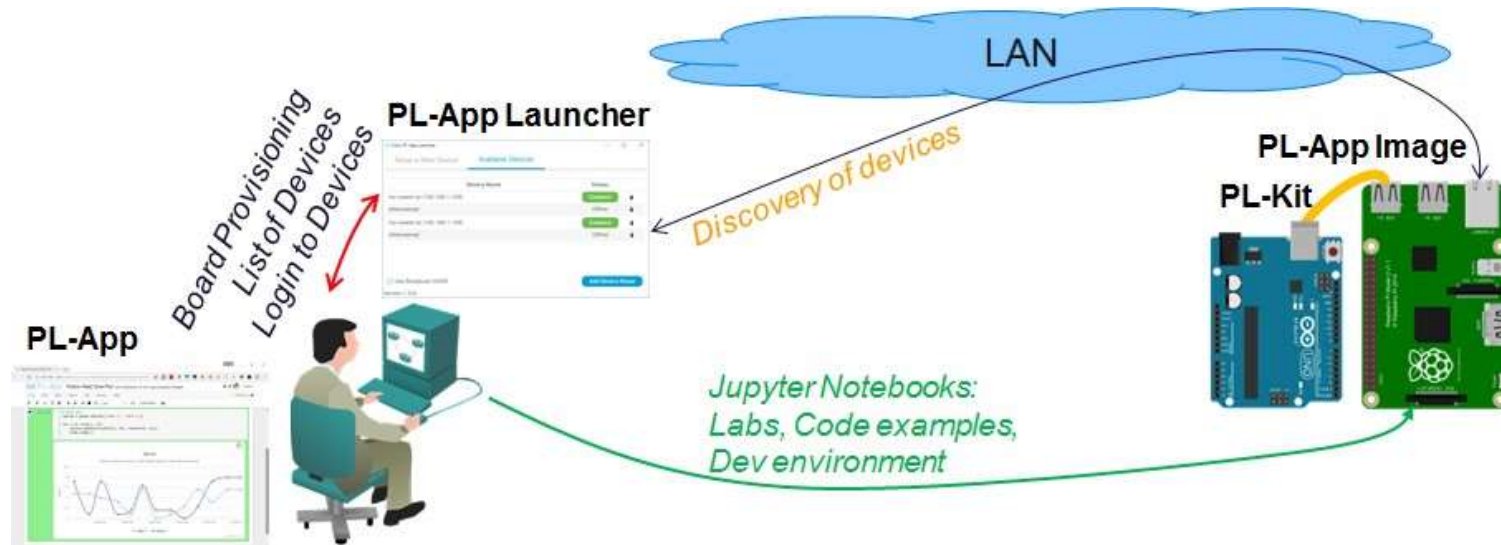
A notebook is an interactive web page where content is distributed in what are called cells. The first cell type is called Markdown and is a cell that contains standard objects such as text, images, videos, etc. The second cell type is called Code cell and is a cell with executable code of different programming languages (the default is Python).

A notebook can be used as a lab where the explanatory text is placed with executable code and together create a scaffolded learning experience. The explanatory text guides the student through the learning experience, while hands on skills are acquired by modifying, examining and executing executable code.

A notebook is also a great tool that can be used to prototype IoT systems, interconnect with existing cloud services using APIs, etc. In a notebook, application code can be split between multiple code cells, executing only the part of the code that is just being developed or troubleshot. Moreover, using markdown cells, documentation and explanatory text can be added between code cells to provide a clean, easy to understand Rapid Prototyping Interface.

PL-App components

- **PL-App Image**
The PL-App Image is a Raspberry Pi SD card image file based on a Raspbian Linux distribution that was customized by Cisco to create an IoT prototyping and learning environment based on Jupyter notebooks on a Raspberry Pi.
- **PL-App Launcher**
The PL-App Launcher is a Windows and Mac application that simplifies the setup of a Raspberry Pi SD card with a PL-App Image, as well as discovers PL-App devices in the local area network.



IoT Fundamentals 2.0 Equipment List

For the Connecting Things course:

- SparkFun Raspberry Pi 3B+ Starter Kit
- SparkFun Tinker Kit

For the 2.2.4.2 and 2.2.4.3 labs the equipment list from above plus:

- o Flex Sensor 2.2"
- o SPDT 5V Relay
- o Transistor - NPN (BC337)
- o Diode Small Signal - 1N4148

For the Big Data & Analytics course:

- Connecting Things 2.0 equipment list from above plus:
- Raspberry Pi Camera Module v2

1: Data & The IoT

Understand the concepts of Big Data & Analytics, and the role of Big Data in IoT systems.

At Rest / Motion

Structured/Unstructured



Open / Private

4 Vs

1: Data & The IoT - Labs

Python Challenge : check required proficiency with Python Programming necessary for rest of the course.



2: Fundamentals of Data Analysis

Learn the basics of descriptive statistics, the practical aspects in acquiring data from a sensor and how to create visual representations of the data.



2: Fundamentals of Data Analysis - Labs

- **San Francisco Crime:** data loading, simple cleaning, basic descriptive statistics and visualization in simple 2D plot and in interactive map.
- **Internet Meter Data Analysis:** real-time data acquisition from RaPi, data manipulation and storing on file.
- **Working with Python and SQLite:** run simple SQL queries on a local database.
- **Internet Meter SQL:** more data manipulation data using SQL from Notebook.



3: Data Analysis

Explore data using statistics and visualization to extract information and create hypotheses.

Statistics building blocks:

- Variable
- Distribution
- Sample /Population
- Descriptive VS Inferential



Data Analytics methods:

- Correlation
- Regression
- Clustering

Exploratory visualization

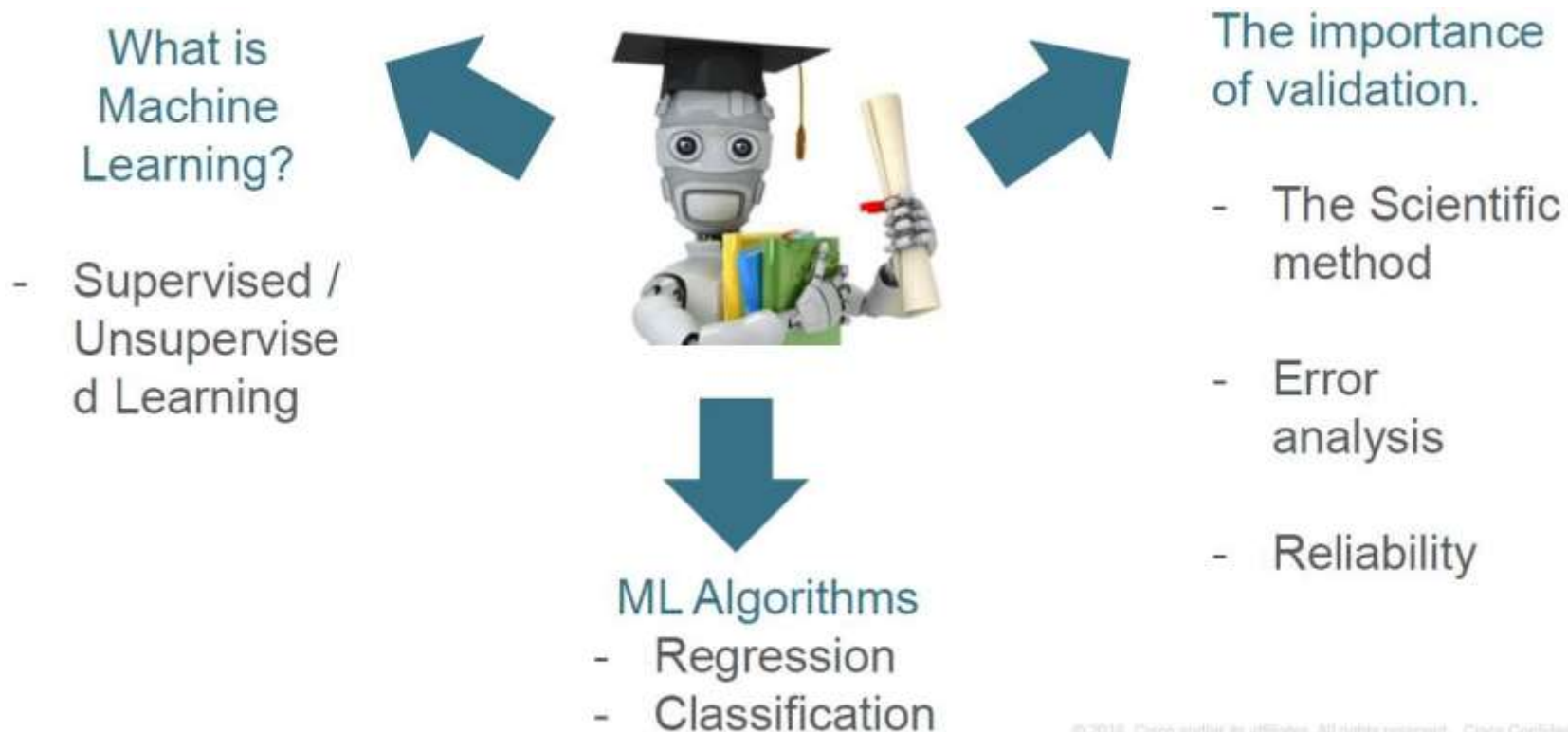
3: Data Analysis - Labs

- **Descriptive Statistics in Python** : descr. analysis and basic visualization
- **Correlation analysis in Python**: calculate and visualize correlation between variables.
- **Working with Python and SQLite**: run simple SQL queries on a local database.
- **Internet Meter SQL**: more data manipulation data using SQL from Notebook.



4 : Advanced Data Analytics and ML

Learn about predictive analytics, the supervised and unsupervised approaches to Machine Learning and how to apply models to make predictions from the data.



4 : Advanced Data Analytics and ML

- **Simple Linear Regression in Python** : learn the basics of simple linear regression.
- **Decision Tree Classification**: learn about the Decision Tree algorithm for classification using classic dataset.
- **Evaluating Fit Error in Linear Regression**: learn how to measure the performance of your regression model.
- **Internet Traffic Data Linear Regression**: beyond simple linear regression: polynomial and exponential models using non-linear solvers.
- **Internet Meter Anomaly Detection**: what is an anomaly?



5: Storytelling with Data

Learn how to transform analytics results into a clear and convincing narrative and visual communication.

Preparation

- Know your audience
- Tell a story with data.



Visualization
libraries / tools.



Types of plot /
visualization

5: Storytelling with Data - Labs

- **Advanced Data Visualization:** load data from DB, combine different types of visualization, visualize mesh data on interactive map
- **Internet Speed Compliance:** use data visualization techniques to make a point: file a complaint to your ISP.



6: Architecture for Big Data and Data Engineering

Learn the basic principles behind the most important scalable solutions for Big Data such as Apache Hadoop and the related ecosystem of technologies.



- Ingestion:
Apache Cassandra

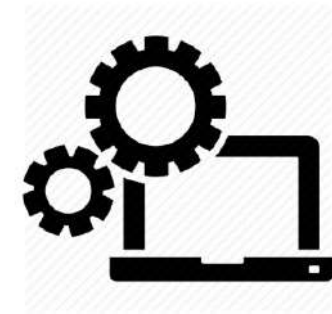
- Storage:
Apache Kafka

- Computation:
Apache Spark



6: Architecture for Big Data and Data Engineering - Labs

- Install and test the RaPi camera: take pictures and visualize them in real-time inside a notebook.
- Image Processing Change Detection: in Python: calculate and visualize correlation between variables.
- Smile Detection : use pre-trained ML model to detect smile on-line using camera and RaPi



IoT Fundamentals: Big Data & Analytics

Version 2.0.1 | Released October 2017

Curriculum Overview

The Cisco Networking Academy's IoT Fundamentals curriculum provides students with a comprehensive understanding of the Internet of Things (IoT). It develops foundational skills using hands-on lab activities that stimulate the students in applying creative problem-solving and rapid prototyping in the interdisciplinary domain of electronics, networking, security, data analytics, and business. The student-centric approach translates into the student being able to ideate, design, prototype and present an IoT solution for an identified business or society need.

There are 3 instructor-led courses in the IoT Fundamentals curriculum: Connecting Things, Big Data & Analytics and Hackathon Playbook. Upon completion of each course, the end of course survey, and the end of course assessment

[Read More](#)

Curriculum Resources

[Scope & Sequence](#)

[Curriculum Overview PPT](#)

[Updated June 29](#) [IoT Fundamentals FAQ](#)

[Prototyping Lab Resources page](#)

IoT Fundamentals Best Practices Library:

NEW! [IoT Curriculum for IoT Developer Technician Role \(English\)](#)

NEW! [IoT Curriculum for IoT Developer Technician Role \(Spanish\)](#)

[Retooling Manufacturing Workforce Development](#)

[New Foundation for 2-Year College IT Program](#)

[Engineering Students Gain Competitive Skills](#)

Big Data & Analytics

[Instructor Training Approach](#)

[Self-paced Instructor Training course \(English\)](#)

NEW! [Self-paced Instructor Training course \(Spanish\)](#)

[PL-App Launcher and Image](#)

[Exam Design Documents](#)

[Translated Instructor Resources](#)

[Instructor Supplemental Materials](#)

[Instructor Lab source files](#)

[Instructor Lab Jupyter notebooks](#)

[Release Notes](#)

[Student Lab source files](#)

[Student Lab Jupyter notebooks](#)

Quick links

[Cisco Prototyping Lab Resources](#)

[Equipment List](#)

[Errata](#)

[Packet Tracer Resources](#)

[IoT Fundamentals Scope & Sequence](#)

[Translated Resources](#)

[Workshop: Experimenting with REST APIs](#)

Latest News

[Mac Users! A New Packet Tracer Releases](#)

April 10, 2019

[Through the Lens of an Attacker](#)

February 05, 2019

[Teach Python with a Self-paced Course – Language of the Year!](#)

January 23, 2019

[Packet Tracer 7.2.1 Now Available](#)

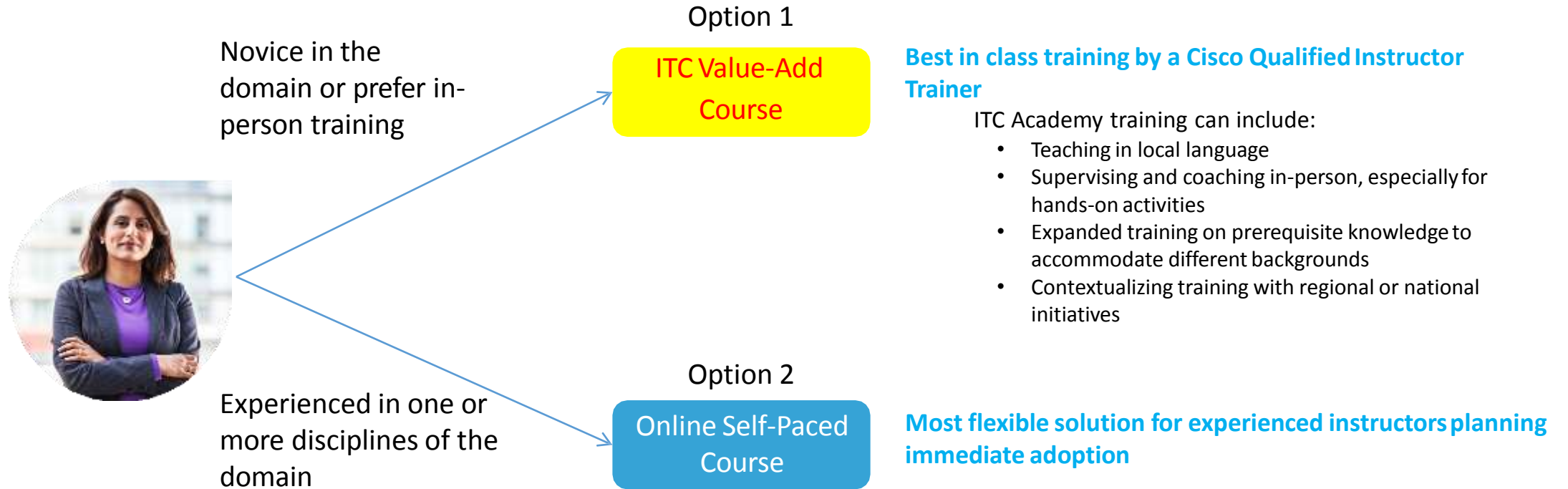
January 02, 2019

[Keep Current with Latest Emerging Technologies Workshops](#)

November 14, 2018

[go to new](#)

Instructor Training Options*



* Consistent with other IoT Fundamentals courses.

IoT Fundamentals

Self-paced Online Instructor Training Course

- Click to enroll from the [IoT Fundamentals Course Resources](#) page.
- Review course materials and instructional videos. Interact with your peers in the forum.
- Pass final exam (min. score 70%, within max3 attempts).
- After passing the exam, take the survey and request your certificate. You will receive Accreditation within 1 week.
- If you do not pass the final exam, go to the next page for the recommended approach.

IoT Fundamentals

Self-Enrolled Course Recommended Retake Approach

- If the instructor candidate does not pass the course final exam on the first attempt, the candidate should review the training course content and attempt the course final exam again.
- If the instructor candidate does not pass the second attempt, the candidate should contact their ASC Academy to discuss the options for taking a formal instructor training course at an ITC Academy or attending ITC delivered IPD activities to prepare the instructor candidate for the last attempt.
- If the instructor candidate does not pass the third attempt, the candidate should engage their ASC Academy to determine the best next step. This could be to attend an instructor training course delivered by an ITC Academy.

| Type | LI | Chapter/Section/Topic Titles | Items | % Coverage |
|------|-------|---|-------|------------|
| CS | 1.0 | Explain the promises and challenges of Big Data analytics as related to the Internet of Things. | 4 | 10 |
| TLO | 1.1.0 | Demonstrate the characteristics and value of data in the IoT. | | |
| TLO | 1.2.0 | Explain the concept of Big Data. | | |
| TLO | 1.3.0 | Compare approaches to data management in the IoT. | | |
| CS | 2.0 | Analyze data using Python and SQLite. | 5,6 | 14 |
| TLO | 2.1.0 | Explain how data is used to create knowledge. | | |
| TLO | 2.2.0 | Use software tools to analyze and visualize data following the Data Analysis Lifecycle process. | | |
| TLO | 2.3.0 | Configure data for analysis. | | |
| TLO | 2.4.0 | Explain why ethics are important when using Big Data. | | |
| TLO | 2.5.0 | Analyze data by using an external application and SQLite. | | |
| CS | 3.0 | Analyze data using basic statistical and data preparation techniques in Python with pandas. | 9,2 | 23 |
| TLO | 3.1.0 | Analyze data using basic statistics. | | |
| TLO | 3.2.0 | Use Python libraries to prepare, analyze, and visualize data. | | |
| CS | 4.0 | Analyze data using machine learning models. | 9,2 | 23 |
| TLO | 4.1.0 | Use pandas to perform simple linear regression analysis. | | |
| TLO | 4.2.0 | Explain issues with evaluating analytics models. | | |
| TLO | 4.3.0 | Analyze data using regression and anomaly analyses.. | | |
| CS | 5.0 | Defend a proposition using data, argumentation, and visualizations. | 6 | 15 |
| TLO | 5.1.0 | Explain the fundamentals of creating an argument from data. | | |
| TLO | 5.2.0 | Explain how to use Python libraries to create the appropriate visualizations for a communicative purpose. | | |
| TLO | 5.3.0 | Create georeferenced visualizations using Folium. | | |
| CS | 6.0 | Explain how data centers and data engineering contribute to Big Data and analytics. | 6 | 15 |
| TLO | 6.1.0 | Explain how the virtualized data center supports Big Data and analytics. | | |
| TLO | 6.2.0 | Explain the history, theory, concept, design, and barriers behind data engineering needs. | | |
| TLO | 6.3.0 | Explain how a big data pipeline supplies streaming IoT data for analysis. | | |
| TLO | 6.4.0 | Analyze digital image data. | | |
| | | | 40 | 100 |