Public Outline and Syllabus

Database Application Development and Programming

The following is a list of anticipated concepts and lesson points for the Marion Technical College Database Applications Programming class. These items are assembled from the requirements for Microsoft Certifications 98-364 (Database Fundamentals) and 98-361 (Software Development Fundamentals), Florida DOE Curriculum Framework Y700300 and other supporting materials. This outline is subject to changes and is not an exclusive list or an indicator of the order in which topics will be presented.

General Information Technology

Overview of microprocessors and digital computer systems

Use of office applications to communicate and organize information

- Word Processing
- Presentations
- Spreadsheets
- Email

Keyboarding skills

Windows file management

Use of reference materials

Strategies for continuous learning and research of emerging technologies

Requirements and practices involved in information security, licensure and ownership

Ethical and responsible use of technology

SQL Programming

Introduction to electronic data storage

Definition and use of databases and comparison with other document types

Understanding database servers and clients

Server vs. Desktop databases

Comparison of Database models with emphasis on the relational model

- Relational databases and ACID compliance
- Referential integrity basics and purpose
- Table Relationship types

Application and Business Specific Database Types
- Definition: Decision Support System (DSS)
- Definition: Online Transaction Processing (OLTP)
- Definition: Relational Database Management System (RDBMS)

SQLCMD and command line operations

Role of database queries

- SQL vs. T-SQL
- Set Theory in SQL
- SQL Queries vs. Commands
- Use of SELECT queries
- SQL Server Transaction Log
- Query execution plans in SQL Server

Using Structured Query Language and associated keywords

- Data Manipulation Language (DML)
  - SELECT, INSERT, UPDATE and DELETE
- Data Definition Language (DDL)
  - DELETE vs. TRUNCATE
- Data Control Language (DCL)
- Operators
- Reserved words
- Aliasing of tables and fields
- Order of Operations
- UNION queries
- Subqueries
- GROUP BY / HAVING clauses
- ORDER BY
- WHERE / predicate logic
- Join Types – Inner, Outer (Left / Right / Full / Self)
- Cross database and cross server joins
- Syntax standards ANSI 89 vs. 92
- AND / OR / XOR operations

SQL Functions

- Aggregate functions
- Type conversion
- In-line vs multi-statement
- Deterministic vs. non-deterministic
- Scalar
- User-defined

SQL Server database system tables

Comparison of SQL Server data types and their attributes
- Collation
- Precision
- Scale
- Length
- Variable and fixed-length
- Data storage requirements
- Eligibility for full-text searches
- Precedence
- Conversion, implicit vs. Explicit

Defining Table Relationships

SQL Views
- NOCOUNT keyword
- Multi-table
- Security / Permissions

SQL Server Stored Procedures
- User-defined functions vs stored procedures
- Views vs stored procedures
- Parameters
- Variables
- Compilation
- System stored procedures

SQL Transactions
- COMMIT
- ROLLBACK
- Savepoints

SQL Server Triggers

Use of Cursors

SQL Injection

Creating SQL Scripts

**Database Design**

Database Planning vs Design

Server vs. Desktop database options

Data Modeling: Conceptual, Logical and Physical

Entity-Relationship Diagrams (ERD)
- E-R Diagrams Basics
- Symbology
- Diagram generation tools

Requirements and Prototyping

Phases of database application design

Identification of Requirements

Functional dependencies

Normalization: Definition, purpose and limits

Understanding and application of Normal Forms – 1NF through 3NF

Boyce-Codd Normal Form (3.5NF)

Definition: Fourth and Fifth Normal Forms

Creation and management of databases
  - File size, max size and auto-growth
  - Database settings
  - Use of filegroups
  - Verifying DB objects prior to creation in scripts
  - SQL Server file types: MDF / NDF and LDF
  - Database vs. Table-level collation

Table Design
  - Database schemas and table ownership
  - Degree, Attribute, Cardinality and Domain definitions
  - Tuples, attributes and entities
  - Column name restrictions and best practices
  - Distinction between primary keys and identity fields
  - Identity fields vs. Row GUID
  - Table column properties
  - Adding Indexes
  - Data Constraints: Unique, Check and Default
  - Defining primary and foreign keys

Table Indexes
  - B-trees
  - Clustered and non-clustered indexes
  - Selection of appropriate fields
  - Unique indexes

Database backup and restore operations
Database replication use and tools

Database security
- SQL Injection and countermeasures
- Creating user accounts and server logins
- SQL Server roles
- sysadmin / dbo rights
- Server and database level security

Import and export of data between storage formats

**General Programming**

(In addition to SQL / T-SQL, students learn about HTML / CSS, JavaScript and Visual C# (including ASP.NET). An overview of the Java language is also given at the end of the course, time permitting. Unless specified, the following topics apply to any or all of these technologies.)

Understanding and use of Integrated Development Environments (IDE)
- SQL Server Management Studio
- Microsoft Visual Studio Community
- Microsoft Visual Studio Code
- NetBeans (Java)

Comparison and design of development project types
- Windows Forms (single and multi-form)
- Console
- Web development (ASP.NET and HTML / CSS)
- Database scripts
- Windows and web services
- Mobile (time permitting)

Identification and management of program dependencies

Introduction to Graphical User Interfaces (GUI)

**ASP.NET Page Model and Webforms construction**

Processing and validation of user input

Use of variables and constants

Selection and use of data types

Comparison of compiled and interpreted applications

Error handling within programs and scripts

Use of Decision structures (if ... else, switch, case, etc...)
Looping operations (While, For / For each, Do While, etc...)

Recursive programming

Boolean (true / false) operations and variables

Interface controls (including)
- Radio buttons
- Check boxes
- Text fields
- Buttons
- ImageLists
- Listboxes
- Menus

Development of custom controls

Reading and writing from text files

Comparison and use of text file formats – CSV, XML, JSON

Use of methods to modularize code
- Methods vs. functions
- Arguments and parameters
- Use and definition of output parameters
- Overloading of methods and functions

Testing, debugging and quality control of methods and entire programs

Value vs. Reference Types

Array operations
- Passing of single values and value arrays to methods
- Sorting and searching of arrays and other data structures
- Multi-dimensional arrays

List types including generics

Advanced string processing and manipulation

Structures vs. Classes

Enumerations and user-defined types

Program access and manipulation of data in databases and other data storage

Program access and use of external APIs (application programming interface) for additional functionality

Reporting tools and design of a reporting solution around a data store

Use of source control and other management tools
Software Development Life Cycle (SDLC)

- Gathering of business requirements and conducting interviews
- Writing and interpreting technical and requirements documentation
- System design processes including individual and pair programming
- Testing processes and methods including unit, integration and user testing
- Creation of user documentation
- Deployment of finished applications
- Support and Maintenance including system enhancements
- Software development methodologies including Agile

Object Oriented Programming

Principles of Object-Oriented Programming

- Inheritance
- Polymorphism
- Abstraction
- Encapsulation

Comparison of OOP and other forms of programming

Definition and use of classes in programs

Use and definition of class properties and fields

Class constructors and overloading

Creation of objects from classes and use in code

Class event definition and firing, creation of event listeners

Business and Interpersonal Skills

Job / career exploration and planning

Leadership and supervision techniques

Customer service strategies

Maintaining ethical standards within the workplace and technology field

Comprehension and communication skills

Oral and written communication skills for use in personal and professional development

Understanding of the professional and personal requirements for a career in software development

Estimated Class Calendar and Program Outline
Example January 2019 – June 2020

The following is an estimated projection of the schedule of study for the Database Applications Programming and Development program starting in January 2019. This is based on the progress and schedule for the previous program and projected changes. All dates are estimates and are subject to change.

Program length: 1200 hours / 60 weeks

January 7, 2019 (estimated): Program start date: The program will begin with intensive study of Structured Query Language (SQL) and database design. This will involve study of the language elements, principles of data organization and normalization and the rest of the material listed under the SQL Programming and Database Design sections of the class syllabus. This will be in preparation for Microsoft Exam 98-364, Database Fundamentals.

March 18 – 22, 2019: Spring Break

June 1, 2019: Exam vouchers for Microsoft Exam 98-364 will be available and students will have the opportunity to start taking the exam at their discretion.

June 13, 2019 (estimated): Last day before Summer break

July 8, 2019 (estimated): Classes resume

During the remainder of July 2019, the class will complete the main study of SQL and database design.

August 2019: We will begin studying HTML, CSS and JavaScript for use in web development with a focus on JavaScript and an introduction to Object Oriented Programming. This period will also begin preparation for Microsoft Exam 98-361, Software Development Fundamentals.

November 2019: During this month, we should be transitioning from JavaScript to Microsoft Visual C#, a general-purpose programming language which is heavily featured on Exam 98-361. This will also be an introduction to the .NET programming environment. This will include study of ASP.NET, the web design portion of the .NET framework which combines C# and HTML.

December 19, 2019 (estimated): Last day before Winter break

January 6, 2020 (estimated): Classes resume

March 16 – 20, 2020 (estimated): Spring Break

May 1, 2020: Exam vouchers for Microsoft Exam 98-361 will be available and students will have the opportunity to start taking the exam at their discretion.

If there is time in the last month of the course, we will have an introduction to the Java programming language, another general-purpose language which allows for development on operating systems other than Windows (cross-platform).

June 18, 2020 (estimated): Graduation