Instructional Scenario
Cafeteria Catastrophe

Course: Advanced Programming

Duty/Concept Areas:

Developing Object-Oriented Programming
Developing Database Applications
Developing Connected Applications (Mobile and/or Web)
Developing Employability Skills

SOL Correlations:
Mathematics: COM.1, COM.2, COM.3, COM.4, COM.5, COM.6, COM.7, COM.9, COM.10, COM.12, COM.13, COM.14, COM.15, COM.16, COM.17, COM.18, COM.19, COM.20, AII.4, DM.3, DM.4, DM.11
English: 11.5, 12.5

Scenario:
Note: This scenario could be an ongoing project throughout the year or a culminating project at the end of the year.

The cafeteria staff in your school has many problems, which include students stealing food, students not paying the correct amount for their food, and students causing disruptions in the cafeteria line. The cafeteria manager has contracted with you to create a program that will track inventory, track sales, calculate a purchase, and store students' disciplinary records.

Big Question:
How would you design a program to meet the needs of the cafeteria staff?

Focused Questions:

- What steps would you take to solve the problems?
- How would you design an interface that would allow the cafeteria workers to resolve all of their issues?
- What programming structures are needed to track inventory (beginning, ending, and replacement)?
- What programming structures are needed to track sales?
- What items should be included in the customers' transactions?
- How would you determine tracking and storing discipline referrals?
- How would you report and track the students' infractions?
- How will you report lost sales and total sales?
- How can you use Internet resources to enhance your program?
- How will you evaluate the effectiveness of the program you created?

Project-Based Assessment:
A professional program should solve the issues identified by the cafeteria staff. The program interface should incorporate accepted advanced programming standards and styles and meet the users' specifications. The program should be error-free with accurate output under different scenarios.

Instructional Scenario
Fantasy Finale

Course: Advanced Programming

Duty/Concept Area: Developing Object-Oriented Programming (OOP)

SOL Correlations:
Mathematics COM.1, COM.2, COM.3, COM.4, COM.5, COM.6, COM.7, COM.8, COM.9, COM.10, COM.11, COM.13, COM.14, COM.15, COM.16, COM.17, COM.18

Scenario:
You have recently been hired by legendary video game developer Rectangle Roc to work on a remake of one of their classic 8-bit role-playing games. They have assigned you to the team responsible for recreating the characters that players can choose from. Rectangle Roc has requested that the initial characters be simple, with only a few defining characteristics. However, they do expect your design to allow for customization and expansion of character abilities as game development progresses.

Characters in your game are initially restricted to the four standard fantasy archetypes: fighter, rogue, cleric, and magician. Each archetype will ultimately be its own unique class. As a team, you must decide which abilities should be standard and shared for each archetype. You will need to agree upon and code an interface that all programmers will use before moving on to the next step. Then each member will independently code the assigned archetypes. They are not only responsible for coding all of the shared abilities their archetypes have, but also with developing two or three unique abilities that distinguish each character from the rest. When independent development is complete, the team will come together again to build a program that will test all the archetypes in the same environment.

Big Question:
How can programmers use OOP to break down large problems into smaller and more manageable pieces?

Focused Questions:

- What are the shared abilities that each archetype will be able to perform?
- How might each archetype perform a shared ability differently from the others?
- What are the unique abilities that each archetype will be able to perform?
- How will an interface help guide the development of these archetypes?
- What code must you write for your individual archetype to work?
- What additional code must you write to meet the requirements of the project?
- How will you organize your objects in your main program for efficient testing?
- What tests will you need to run to ensure your objects are working properly?
- What test cases are necessary to ensure your objects are working properly?
- How did using OOP strategies simplify the task of this project?

Project-Based Assessment:
The end result will be a package of at least six program files: an interface, four objects representing each of the four archetypes, and a main program used to test all the objects. The programs should be error free and include appropriate comments throughout the code. The programming testing the objects should check the

functionality of all objects for a wide range of possible test cases.

Resources:

- What is an Interface? – Oracle
- Interfaces in Java – GeeksforGeeks
- What is an Interface in Java with Example – Guru99

Scenario submitted by Jeffery Timmerman, Brooke Point High School, Stafford County Public Schools

Instructional Scenario
An App to Track FBLA Committees

Course: Advanced Programming

Duty/Concept Areas:

Developing Object-Oriented Programming (OOP)
Developing Connected Applications (Mobile and/or Web)

SOL Correlations:
Mathematics AFDA.1; AII.3; COM.1, COM.2, COM.3, COM.4, COM.5, COM.6, COM.7, COM.8, COM.9, COM.10, COM.11, COM.12, COM.13, COM.14, COM.15, COM.17, COM.18

Scenario:
FBLA has been using an app for two years that allows members to login and view news about their local chapter and provides a link to the national FBLA website. The FBLA advisers have asked for a way to track their chapters' committee members. The different committees are Community Service, Fundraising, Leadership, and Social.

You are to develop the activities/views screen for the committee upgrade. The first version is to have a screen with a list of committees. When the user chooses the committee, the app will allow the user to view all the committee members, including the adviser. The app should allow members to add/remove themselves to/from the committee and allow advisers to edit the list.

Big Question:
What activities/views would you create, and how would you code them?

Focused Questions:

- On what platform will you develop your solution?
- How will you store the data?
- How will the different activities/views interact and exchange data?
- What other options would you suggest to the committee upgrade?
- What is the minimum version that will support your app?
- Will you create classes for your data storage?
- If necessary, how will you handle bad user input?

Project-Based Assessment:
The finished app, upgrade segment only, should have more than one activity/view with the ability to move from one activity/view to another. The data should update appropriately.

Resource:

- Tutorials for using Xamarin, which can be used for multiple platforms or just developing on Android or IOS

Scenario submitted by Michael Weber, Advanced Technology Center, Virginia Beach City Public Schools

Instructional Scenario
Putting It All Together

Course: Advanced Programming

Duty/Concept Areas:

Developing Object-Oriented Programming
Developing Database Applications
Developing Interactive Multimedia Applications
Developing Connected Applications (Mobile and/or Web)

SOL Correlations:

Mathematics: COM.1, COM.2, COM.3, COM.4, COM.5, COM.6, COM.7, COM.8, COM.9, COM.10, COM.12, COM.13, COM.14, COM.15, COM.16, COM.17, COM.18, COM.19, COM.20, A.1, A.2, A.3, A.5, A.6, A.7, AFDA.1, AII.4, AII.6, AII.7, DM.3, DM.4, DM.11, G.1, G.3, G.11, G.14, T.6
English: 11.4, 11.7, 11.8, 11.10, 12.4, 12.7

Scenario:

Note: This scenario could be offered as an ongoing project throughout the year.

You are a programming contractor bidding for a project offered by a sales business to create all the programming applications they need. The salespeople need secure access through an interface to all the data that will help them sell their product. When on the road, they also need to document their travel expenses, interactions with clients, and sales. An online, e-commerce site must also record order and inventory details, market the product, and securely process customers' financial and personal information. The shipping department needs to record inventory and process orders. You must pick a team of programmers (i.e., classmates) to help you develop the system. Your objective is to win the contract at the highest rate of return and deliver an exceptional system.

Big Question:

How do you get all applications working together in a seamless environment?

Focused Questions:

- What are the application design steps?
- What are the objectives of each application?
- What should be the design features of each application?
- Who is the target audience for each of your applications?
- Which platform should you choose?
- What should be the look-and-feel features of each application?
- What interface will you choose?
- What input and output devices will you offer to employees?
- How will you provide accessibility for all?
- How should you document your project?
- What will your user instructions say and how will you deliver them?
- What type of data will you record and manipulate?
- Will you allow employees to submit reports?
- If so, how should these look?

- What data will they contain?

Project-Based Assessment:
Assess outcomes, using a rubric.

Instructional Scenario
Recycling Rush

Course/Duty Area:
Advanced Programming/Developing Interactive Multimedia Applications

SOL Correlations:
Mathematics COM.1, COM.2, COM.3, COM.4, COM.5, COM.6, COM.7, COM.8, COM.9, COM.10, COM.11, COM.12, COM.13, COM.14, COM.15, COM.16, COM.17, COM.18
Science LS.11

Scenario:
Your school's environmental club is frustrated because students keep putting garbage in the recycling bin. Not only is it unpleasant for them to sort through, but it also degrades the quality of actual recyclable material. In some cases, the contamination is so bad that everything in the recycling bin must be thrown away. Adding more trash to the landfills is unacceptable, so the environmental club wants to start an awareness campaign to teach students what they can and cannot recycle.

The environmental club has asked you to create an educational game to teach players what refuse can be recycled and what must be thrown in the trash. Club members have given you complete creative control over the project. They do not care about the genre of the game, the platform it is developed on, or how you get the message across. They are only concerned that students who play the game learn about appropriate recycling at school.

Big Question:
How can you design a program to meet a specific need or elicit a specific change?

Focused Questions:

- How can you expand a single-player concept into a multiplayer game?
- What role will each player have in your game?
- How will the players interact in your game?
- How will you manage the complexity of your multiplayer game?

Project-Based Assessment:
The final product should be a game that meets the criteria set above. The program should be error-free and include appropriate comments throughout the code. The program should be tested thoroughly prior to submission to check for possible errors.

Scenario submitted by Jeffery Timmerman, Brooke Point High School, Stafford County Public Schools

Instructional Scenario
The SOL Game

Course: Advanced Programming

Duty Areas:

Developing Object-Oriented Programming
Developing Interactive Multimedia Applications

SOL Correlations:

Mathematics: COM.1, COM.2, COM.3, COM.4, COM.5, COM.6, COM.7, COM.8, COM.9, COM.10, COM.12, COM.13, COM.14, COM.15, COM.16, COM.17, COM.18, COM.19, COM.20, A.1, A.2, A.3, A.5, A.6, A.7, AFDA.1, AII.4, AII.6, AII.7, DM.3, DM.4, DM.11, G.1, G.3, G.11, G.14, T.6
English: 11.5, 11.6, 11.7, 12.5, 12.6, 12.7

Scenario:

Note: This scenario could be offered as an ongoing project throughout the year.

An elementary school teacher has requested a Mathematics Standards of Learning review game that will help students learn basic mathematics skills (e.g., addition, subtraction, multiplication, division). The game will be used for students in grades K-5. The teacher has requested that the game have a user-friendly, colorful interface. The instructions on how to use the game should be very simple and should appear within the interface. The student will be able to access a mathematical problem through the interface and supply the answer. If the answer entered by the student is not correct, the program should notify the student and provide a chance to correct the answer. If the second answer entered by the student is not correct, the student will be given the correct answer along with a message that encourages the student to continue to study the math concepts. Individual games should be scored by percentage of correct answers.

Big Question:

What are the key design features required for this game, and what are your constraints?

Focused Questions:

- What are the game design steps?
- Who is your audience?
- What is your content?
- Which platform should you choose?
- What are your look-and-feel features?
- What input and output devices will you offer to players?
- Will you provide accessibility for all?
- How and why should you document your production?
- What will your user instructions say, and how will you deliver them?
- What type of scoring will you provide?

Project-Based Assessment:

Assess outcomes, using a rubric.

Instructional Scenario
Video Game Rental

Course: Advanced Programming

Duty/Concept Areas:

Developing Object-Oriented Programming (OOP)
Developing Database Applications

SOL Correlations:

Mathematics AII.3, COM.1, COM.2, COM.3, COM.4, COM.5, COM.6, COM.7, COM.8, COM.9, COM.10, COM.11, COM.12, COM.13, COM.14, COM.15, COM.17, COM.18, DM.8

Scenario:

The owner of a video game rental service wants to upgrade the store to the digital age with an online interface. The owner wants to have a front end for the customer to search through the available games. The customer will be able to put rentals into a "cart" and be able to check out. After checkout, the program will update the database automatically. The program should meet the following criteria:

- Allows customers to search through all games
- Allows customers to search by game ratings
- Allows customers to check out in-stock games. The checkout process should be seamless, meaning customers should be able to search and pick until they are done. (The customer should not have to check out each time they want a game, just at the end.)
- Provides a way to view the inventory available and the inventory checkout. The owner wants to know the number of each game in inventory and the number checked out.

Big Questions:

What other upgrades or options would you suggest the owner have incorporated into the program?

How would you design the program, and what tools would you use to get the program done?

Focused Questions:

- For the back-end, what tables do you need?
- What relationships will the tables have?
- For the front end, how will you design the user interface?
- For the programming part, what objects/classes are needed?
- How will you handle user input errors?
- When will you update the database?
- How will the front end communicate with the back end?
- What are some important test cases for when you run your program?

Project-Based Assessment:

A finished program, this could be just what the owner wants or it could be more (see big question). The team/individual will also present the user interface and show the database updating. After the presentation, the teacher or other students can ask how a certain item/task was coded.

Resource:

- Tutorial for implementing a C# program that connects to a database (and files)

Scenario submitted by Michael Weber, Advanced Technology Center, Virginia Beach City Public Schools

Instructional Scenario
You Be the Judge

Course: Advanced Programming

Duty/Concept Areas:

Developing Connected Applications (Mobile and/or Web)
Developing Employability Skills

SOL Correlations:

Mathematics: COM.1, COM.2, COM.4, COM.5, COM.6, COM.7, COM.9, COM.10, COM.12, AFDA.1
English: 11.4, 11.7, 11.8, 11.10, 12.4, 12.7

Scenario:

You are an employee who has recently been promoted to manager of the Information Technology (IT) department for a large accounting firm. Your department has received a request to create a small Web-enabled application that would convert loan periods into due dates. You asked a young programmer in your department to create a program that would accomplish this task. Shortly after the employee loaded the program on the company intranet, an e-mail listing all employees' confidential salary information went out from your firm under a bogus account. After investigating this situation and conducting interviews with key staff members, you discovered that the employee did not write the program but copied it off the Internet. It was determined that the code contained a version of the password-stealing worm called Hazif-C. Apparently, the worm-stealing code sent the administrative password to a hacker, who then illegally entered the company e-mail server and sent the e-mail. Upon further scrutiny of the employee's résumé, you also discovered that the employee may have fraudulently claimed to have earned programming certifications in MCSD for Microsoft .Net and Brainbench Visual Basic.

You have been asked by the company's vice president to investigate this situation and create a report to be submitted within five days. The report should contain your recommendations, including suggestions about how to design Web applications with improved security features.

Big Question:

What steps should you take to investigate this situation and prepare a report for management that would include a recommendation of how to deal with the employee who created the problem?

Focused Questions:

- What is the nature of the Hazif-C worm?
- What legal and ethical issues are associated with this situation?
- What recourse does the company have to deal with the employee who created the problem?
- How can the employees' certifications be verified?
- What action should the manager take to deal with the employee?
- Do you, as the newly appointed manager of this department, bear any responsibility for the problem?
- Should you assume any responsibility?
- What security measures should the company implement to prevent this problem from happening again?

Project-Based Assessment:

A report that fully explores

- the ethical issues surrounding copying code from a copyrighted Internet source
- the legal issues surrounding introducing a worm into the company network
- the implications of fraudulent claims on the résumé
- the security measures that should be taken to protect sensitive information.