Sample Scenarios for Integrated Projects

1. **Project Title:** The Secret Ingredient—Nutritional Analysis of Selected Food Items

    Scenario:
    Today's consumers are presented with a significant amount of information on their food products. The USDA has created laws and regulations with the intent of helping to clarify food product labeling for better understanding by consumers. The Nutrition Labeling Education Act became law in 1994 and was established to provide consumers with easy to understand information about the nutritional content and ingredients found in food products. The law established a uniform nutrition facts label that food manufacturers were to utilize in labeling their products.

    While the FDA has created regulations with consumers' best interests in mind, they do not have a very aggressive food labeling compliance protocol. The FDA performs random testing on a selected number of domestic and imported food items to test for nutrition labeling compliance, and issues warning letters and recalls as needed depending on the results of their testing. Many consumers feel that this testing is not broad enough to fully enforce truth in labeling by all food manufacturers.

    There are many independent nutritional analysis labs across the country that provide nutritional analysis and FDA-compliant food labeling assistance to food product manufacturers. These labs conduct special laboratory analyses to provide accurate nutrition data to meet full labeling compliance. Your group represents a team from a nutritional analysis firm who specializes in food product analysis. You have been assigned a customer who needs you to provide the basic nutritional analysis portfolio for a food product.

2. **Project Title:** Targeting Superman's Supergenes Using DNA Microarray

    Scenario:
    Since Alexander Fleming discovered Penicillin in the nineteenth century, we've been successfully using modern antibiotics to control the morbidity and mortality associated with bacterial infections. However, after a century of controlling pathogenic bacteria, the bacteria are fighting back and "superbugs" have evolved. Sixty years ago, *Staphylococcus aureus* could be successfully treated with penicillin, but now nearly all strains are resistant and many are resistant to multiple antibiotics, making infections with these bacteria very difficult to treat. Antibiotic resistant bacteria are an enormous public health problem and many resources and much research is geared toward trying to determine how to make these superbugs susceptible to our own natural defenses or novel drug therapies. One such avenue of research is gene therapy.

    As a researcher, you will use the basics of microarray technology to examine the difference in gene expression of Superman and his mild mannered alter-ego, Clark Kent. Can you locate the genes that render the superhero defenseless in the presence of kryptonite?

3. **Project Title:** Tsunami Detection Network

    Scenario:
    Since the deadly Indian Ocean incident in 2004, there are very few people in the world who haven't heard the word "tsunami." NOAA has been expanding the network of sensors since 2004, and now has an array of sensors around the Pacific Ocean. The network of sensors is on buoys anchored around the Pacific and relay their data via satellite, to a ground-based network, eventually reaching the Tsunami Warning Center.

    Your employer, Tall Water Associates, has a grant to install an early response network of tsunami sensors. A Request for Proposals (RFP) asks for bids that include a working network model that Tall Water will test for robustness under adverse conditions. The RFP specs require sensors connected by both wireless and land-based links to a central server, as well as monitoring stations connected to the network/data server. A topology constructed with a computer aided design tool will facilitate the presentation to Tall Water Associates by potential bidders. As a proof-of-concept, the network should simulate remote and distant connections between: two sensors at sea, two land-based sensors, and a home-based server and monitor.

4. **Project Title:** Greening the Supply Chain: The Carbon Footprint of an Apple

Scenario:
You are an employee in the sales and service department of an urban Midwestern grocery store chain. It is your responsibility to arrange for the shipping of fresh commodities from the point of purchase (the farm, co-op or warehouse) to the store's distribution center, and on to the retail outlets the chain owns. Recently, it has come to your manager's attention that customers of the store are more and more interested in purchasing locally grown produce. This interest in local products reflects the importance among shoppers to get the freshest food possible. Also of concern is the carbon footprint associated with foods shipped long distances. These issues are part of a general interest in Greening the Supply Chain.

To address this challenge, your boss has asked you to determine the environmental impact of transporting the commodity from your current suppliers of apples. The storage facility for your company is in Aurora, Illinois. Your research assignment is to determine the distance shipped, the mode of transportation used, and the type and amount of fuel consumed for each shipment of apples you receive. Currently you are getting apples from Wellington, New Zealand where they are shipped by sea to Los Angeles then by air to Chicago and by truck to Aurora; and Benton Harbor, Michigan, where they are shipped by truck directly to the warehouse. Which supplier has the smallest carbon footprint?