Project

Objectives

- To apply the principles of Operation Processes to real business situations.
- To solidify the computer simulation skills and put them into practice.
- To reinforce business problem analysis skills.
- To enhance teamwork skills.

Overview

- Project Context: Any manufacturing or service operation that the team is familiar with and can analyze. Note: due to Covid, it is not advised that the team visits the operation in person. Instead, choose an operation that you recall from having visited it in the past.

- Some examples are: a local coffee shop, a McDonald's drive-through, a nearby fast food chain restaurant location (Chipotle, Starbucks, etc.), a walk-in clinic, the process of getting your driver's license at the DMV, the process of checking your luggage and going through security at the airport, etc.

Instructions

The project consists of two parts:

- **Part 1**: **Process Analysis and Sensitivity Analysis**:
    - The project begins by selecting the business you are going to analyze.
    - HINT: In choosing a process, remember that queueing and simulation are tools that we use to deal with *variability*. Try to identify the sources of variability in the process you are analyzing. If everything (arrivals, processing times) is deterministic, then that is probably not a good process to analyze (e.g., fully automated processes)!
    - The first part consists of describing the process as it currently is. You should include a process flow diagram of the current process.
    - Next, you should include a simulation of the current process to get performance metrics. The team should decide what the relevant process performance measures to report are (for example, server utilization, average number of customers in line, etc.).
    - You will need to make assumptions about the arrivals and services times. Exponential distributions are a good assumption.
    - Next, you need to conduct a sensitivity analysis. This implies varying the arrival and service patterns to see how it affects the system performance. For example, if you assume that the arrivals are exponentially distributed with an average interarrival time of 10 mins, you should analyze how the simulation outputs would change if the average of the interarrival times was instead, for example, 5 min or 15 mins.

- **Part 2**: **Process Improvement**:
    - You will propose one or two process improvement recommendations.
    - HINT: When thinking about recommendations, go back to our earlier classes and go through all the topics we covered in class this semester. This can give you some good ideas. Some examples are: balancing the line, changing the routing of the process, combining or separating activities, training employees to reduce service times, adding workers, or more creative ideas about how to modify the process to improve in some particular performance metric.

- <u>You need run your simulation again after implementing the proposed changes.</u> You should compare the process performance metrics <u>before and after</u> the proposed process improvement.
- <u>Note:</u> While your recommendations should be realistic, it is OK to propose some "long-term" suggestions (which may not be feasible in the short-run but that could be implemented in a longer horizon). This means: it is OK to be creative with your recommendations! For example, you may suggest that a restaurant expands its waiting area, even though they currently have no space to do so.

Submission

You have to submit the following three files: (All deliverables submitted through Canvas)

1. **Term Project Report** (Paper) and supporting documents
2. **ProModel file (or files)**
3. **Presentation** ("elevator pitch") slides (PPT file)

Grading Criteria for Group Performance (100 points) ❖

ProModel*:*

➢ Model logic and consistency with the written description of the model.
➢ Complexity of the simulation model should be consistent with the level of complexity covered in class; the model should also be correct and well analyzed.
➢ Depth of understanding of the model and practicality of the analysis or recommendations.

❖ **Project Report:**
➢ Structure, Content, Exhibits.
➢ Clarity and depth of analysis will be critical. The report should demonstrate a deep understanding of basic Operation Processes concepts and tools from the course and their application to the operation studied.
➢ Recommendations should be feasible and implementable. However, they can also be "long run recommendations" (if you think of good and innovative recommendations, these are good alternatives to explore even if you don't expect that the firm will be ready to implement them right away).

❖ **Presentation:**
➢ The presentation will have the format of an "elevator pitch". You will be able to use in **total 2 slides** which should include: 1) a description of your model (you should include a screenshot of your Promodel simulation), and 2) show your main results (simulations outputs) and recommendations for the firm.
➢ Since you only have 3 minutes to present, **conciseness and clarity** are key.

Term Project Report Guidelines

The written report should be typed. The length of the report is strictly limited to 12 pages, including any exhibits. Please use the following framework to organize your paper.

Part 1:

- *Executive Summary (No more than 1 page)*
     Briefly state the problem, your recommendation, and the projected benefits of implementing your recommendation.

- *Introduction and Background Information (No more than 2 pages)*
    i) *Business Background:* This section should focus on background information regarding the business and its operation. *ii) Facility Background:* This section should specifically address details pertaining to the facility that you investigated.
    iii) *Primary Goals of the project and the structure of rest of the report:* Here you briefly describe the goals of the project, why you chose this company, and what you expect to help them with.

- *Current Process and Problem Definition (Important)*
    i) *Characterization of Current Process:* In this section, a clear description of the current process should be provided and a detailed **process flow diagram** should be attached to characterize the various states in the production or service process.
    ii) *Problem Statement:* In this section you must describe <u>the main questions to be addressed</u>, what process metrics/measures will be simulated, and how the simulation reflects the current system performance. This sub-section sets the stage for why you have undertaken this project and how your analyses and recommendations may improve the performance of the system.

- *Simulation Overview (Important)*
    i) <u>*Static Simulation Elements:*</u> Provide an overview of the <u>static components</u> of your simulation model. It may include a selected list of locations, entities, resources, path networks and how they are set up.
    ii) *Arrivals, Processes, and Move Logic:* Explain the critical <u>dynamic components</u> of your models. If you have used advanced controls beyond class discussion, briefly describe them. ***You will need to make assumptions about the probability distributions for each component (interarrival time, service time, movement distances).*** The assumptions need not to be an exact match for the true system, but they should be reasonable. Clearly state and explain your assumptions. Provide a sensitivity analysis describing how the simulations outputs change if you slightly vary your assumptions about the arrival times and service times. ***iii) Simulation Setup:*** Explain how you set up the simulations, length of simulation time, and the number of replications, warm-up, etc.
    iv)   Include **screenshots of your simulation model and outputs**. Use the screenshots to explain as clearly as possible how your simulation model works and what results you got.
    v)   If you are analyzing a process where demand fluctuates a lot during the day, you may consider focusing only on peak hours. There is no much improvement to be done in a business that is working at very low utilization (or empty).

Part 2:

- *Analyses, Comparisons, Recommendations, and Conclusions (Important)*
    - *i)* Analyze the simulation outcomes and summarize them.
    - *ii)* Based on your analysis, discuss how the system changed/improved (bottleneck, resource allocation, scheduling efficiency, etc).
    - *iii)* Make recommendations to improve the process and simulate the modified settings and analyze the improvements. (Remember to submit all ProModel files including the old and the modified scenarios). *iv)* Ideally, you can run a process simulation both, <u>before and after introducing the change</u>s you recommend.
    - *v)* Finally, **<u>link your recommendations to concepts learned in class throughout the semester</u>**.

- *Appendices (No more than 5 Pages).* Please attach relevant exhibits, tables and figures (if any).