### ISyE 4803-REV: Advanced Manufacturing Systems Modeling and Analysis Instructor: Spyros Reveliotis Fall 2019

# Homework #1

# Due Date: Monday, 9/16/19

### **Reading Assignment**

- The introductory set of PowerPoint slides presented in class, accessed at: http://www2.isye.gatech.edu/~spyros/courses/IE4803/Fall-17/course materials.html
- Chapters 1 and 2 from your textbook.
- The material on Assembly Line Balancing (ALB) posted at the library electronic reserves.

# **Problem set:**

- A. Solve problems 26, 42 and 43 from the material on ALB posted at the library electronic reserves.
- **Remark:** When some of these problems refer to *the "theoretical minimum number of workstations required for achieving a certain cycle time"* (or the corresponding throughput level), essentially they mean the lower bound for the optimal solution that was discussed in class.
- B. Use your background from your IE3232 class and/or the material of Chapter 2 in your textbook, in order to solve problems 2.1 and 2.2 at the end of Chapter 2 in your textbook.
- C. Finally, answer the following questions:
  - a. What are the three primary attributes that define the modern corporate competition from a strategic standpoint? For each of these attributes, provide an example of a company that places its primary emphasis on that attribute (and explain your answer).
  - b. Discuss how the need to maintain a higher level of responsiveness to potential demand upsurges might lead to an increase of the company's operational costs. Also, consider how the effective deployment of modern information technology can help companies improve their responsiveness without experiencing the operational cost increases that were suggested above.
  - c. Which of the layouts discussed in class would you choose for a discrete-part manufacturing company that experiences frequent changes in its product portfolio? How, in your opinion, could such a company control the operational complexities and the costs that might result from these changes?
  - d. What is the meaning of *stability* for a manufacturing workstation?
  - e. Provide a mathematical argument, based on your IE3232 experience, to establish that at workstation which is operated in a stable mode, long waiting times for the processed jobs imply a high concentration of material at the workstation buffer, and similarly, a high concentration of material in the station buffers implies long waiting times. Conclude that high WIP concentrations and long waiting times are essentially two different facets of the same basic concept, i.e., that of *congestion*!
  - f. What is the primary motivation for a "pull" production control scheme?
  - g. Consider a heuristic for the ALB problem that is similar to that of the ranked positional weights discussed in class, but instead of ranking the involved tasks in decreasing order of positional weights, it ranks them in decreasing order with respect to the number of their successors. Would this heuristic provide correct solutions? Explain your answer.