Setting Up Shop

Group assignment – PPU430/PPU432 Simulation of Production Systems – Fall 2020

Developing production competitiveness through DES in a Skateboarding factory

SK8 & Sons, a global manufacturer of sporting goods, plans to start a new skateboard factory, but is not sure about the feasibility of its business plan. SK8 decides to consult experts (you and your colleagues) to assess the plant capacity and the investments required for its setup. SK8 asks the group of experts to simulate the operation under push and pull production strategies.

The skateboard factory will manufacture only decks and wheels, and buy the other components (Figure 1). In addition to the assembled skateboards, the company will sell parts and accessories. The company is being designed to operate under make-to-stock (MTS) production strategy and the plant will produce in batches of fixed size. The batch production consists of a sequence of one or more steps that must be performed in defined order and, when the sequence is completed, a finite quantity of finished products is produced. Figure 2 presents a description of the production process.

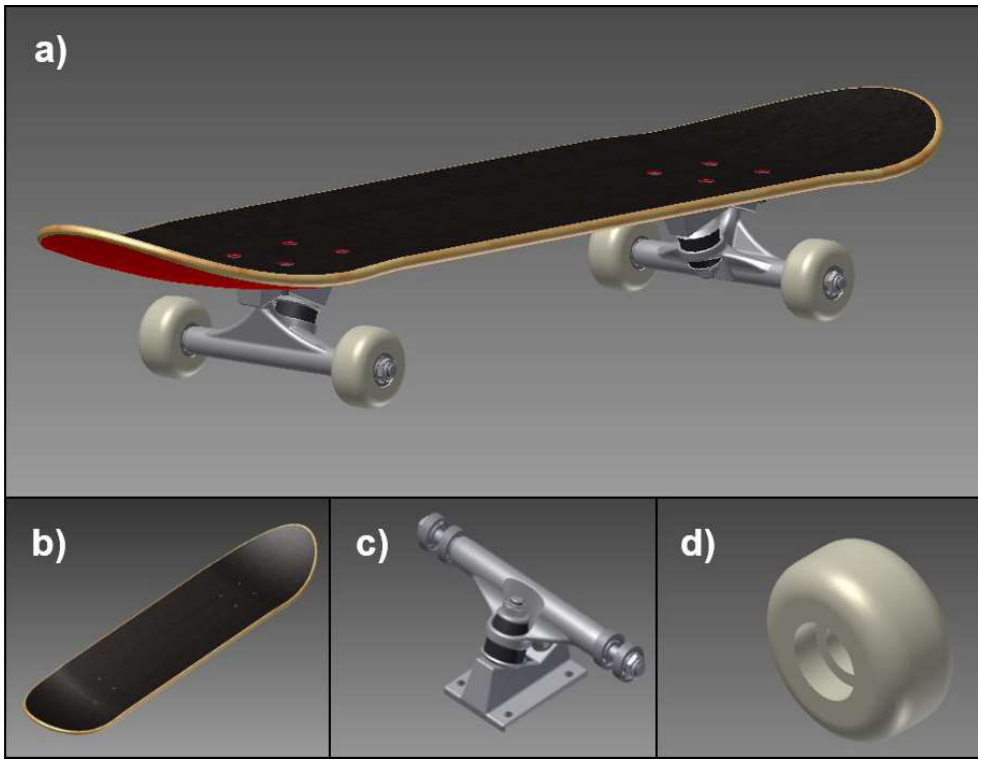

Figure 1 – Skateboard parts a) skateboard, b) deck, c) truck, and d) wheel.

The manufacturing of decks is divided into three stages, each taking place on a different day and with intermediate storage in between. The first stage consists in the pressing of sheets of wood to form the boards, which are then sent to the storage area. On the next day, the shaping processes (cutting, drilling, and finishing), and the painting (sealing the deck) are done, and the boards are left in the drying area until the next day. On the final day, the printing of the art at the bottom of the deck occurs and the finished decks are sent to packaging or assembly.

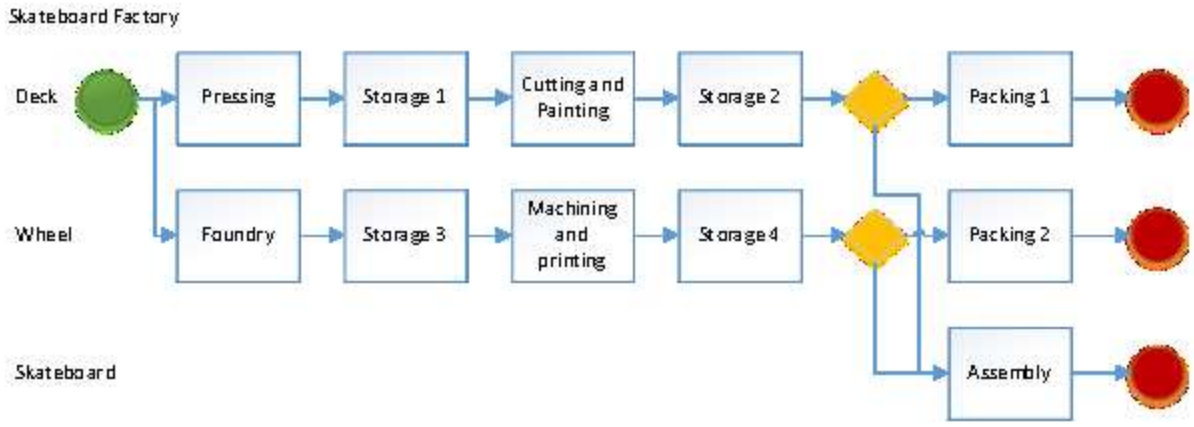

Figure 2 – Production process at the skateboard factory

Similarly, the manufacturing of wheels takes three days, with intermediate storage as well. On the first day, the casting of the wheels is made. On the second day, the machining and printing are made. Finally, on the third day the wheels are sent to packaging or assembly. Additionally information about the history and process of skateboard manufacturing is available in the following links:

http://www.madehow.com/Volume-6/Skateboard.html

https://www.youtube.com/watch?v=zcah04WfCT8

Table 1 shows the estimates of the standard times of the main processes and the corresponding critical resource. Packing the decks and the assembly and packing of skateboards are planned to occur in the same work center. The factory should operate in an eight-hour shift day five days a week. All this information is provided by the entrepreneur in the business plan and is subjected to criticism and review by the consultants (you) at their discretion. Table 2 presents the demand for a standard month. For the purpose of this analysis, SK8 assumes that all months include 20 days.

Table 1 – Parameters of production process

Process	Product	Lot size (unit)	Process time (min/lot)	Critical resources	Quantity (unit)
Pressing	Deck	24	100	Press	4
Cutting	Deck	24	60	Worker	3
Painting	Deck	24	20	Worker	1
Finishing	Deck	24	15	Worker	1
Foundry	Wheels	192	55	Furnace	1
Machining	Wheels	192	60	Lathe	2
Printing	Wheels	192	20	Printing machine	1
Packing Decks	Box of decks	12	10	Worker	2
Packing Wheels	Set of wheels	48	30	Packing machine	1
Assembly line	Skateboard	24	30	Worker	2

Table 2 – Forecasted demand

Product	Demand (per month)
Skateboard	5280
Box of Decks (8 units)	440
Wheels package (4 units)	2640

The production process described above is subject to variation related to breakdowns, quality issues, and the inherent variability of manual processes. In addition, the factory expects variation to the demand of products and parts during the year. SK8 assumes that all material with quality defects cannot be reprocessed, and therefore should be considered scrap.

SK8 would like to evaluate work-in-process inventories, idleness of equipment, bottleneck processes, and how the factory responds to demand and production uncertainties as part of this analysis. SK8 expects DES models of a push and a pull production systems answering the following research questions:

1. What results may be obtained from push and pulls systems?
2. Does the production system have the capacity to meet the forecasted demand?
3. What are the bottleneck of the production process?
4. Are the resources well balanced?
5. How can the model be used to define inventory levels and capacity of storage areas?
6. How can you maximize the throughput of the factory by incurring in the least number of changes to the existing proposal?

SK8 expects the consultants (you) to deliver a visually appealing DES models of the factory with the following requirements:

a) The entire process should fit into a single computer screen
b) The consultants should propose a layout for the factory, and this layout should be mirrored in the DES models
c) The DES model should closely represents the processes and resources in the factory (the use of hierarchical modeling is expected)
d) Graphs generated by the DES models should be exported to Excel and should provide clear information about the issues of concern to SK8
e) When running the model in animation model, the model should show the level of utilization of machines, and whether or not breakdowns take place