

PPQC EXAM (June 2019)

Question 1: General questions (36.5 of 43 points)

- a. List the seven types of waste initially recognized by Toyota. (5 of 5 points)
- b. In a focused work center, machines are dedicated to product families. (i) Explain what the advantages are to dedicate resources to product families. (2 of 2p) (ii) Explain circumstances under which a focused work center is preferred over a focused flow line or work cell. (0 of 2p)
- c. In the chapter on Focused Factories and Group Technology, Nicolas states that “a production line should be curved”. (i) Give an example of a curved production line. (1 of 1p) (ii) Mention two advantages of a curved production line. (3 of 3p)
- d. According to Nicholas, inventory is the root of all evil. However, it can be said that inventory is just a symptom of the real root of all evil: variability.
- (i) Explain the relation between variability and inventory. (1 of 1p)
- (ii) Provide examples of three sources of variability that should be avoided as leading to unnecessary inventory, (3 of 3p) and
- (iii) Give two sources of variability that might be a choice or prerequisite for increasing customer satisfaction (3 of 2p).
- e. (i) What is Pokayoke and why is it used? (3 of 3p) (ii) Provide one example of Pokayoke in production of goods. (0 of 2p)
- f. Explain whether the performance criterium ‘speed’ is typically higher in a process layout or in a product layout. (3 of 3p)
- g. Describe two circumstances under which preventive maintenance is better than corrective maintenance. (1.5 of 3p)
- h. A manufacturer produces 200 units of product P per day of 8 hours. They use a two-card pull system. Each product P needs two components A, two components B, and one components C. The container size of component C is 50 pieces. Transportation of a full container of C takes 15 minutes. Transportation of the conveyance card itself takes 15 minutes as well, and the combined waiting time of the conveyance card (upstream and downstream) is 60 minutes. Total waiting time for the production of C (excluding setup time) is 1 hour. Production of C takes 5 minutes per piece. Setting up the machines to produce a batch of component C takes on average 30 minutes. The organization uses a 20% safety factor.
- (i) Mention at least 4 requirements/rules for pull production (2 of 3p)
- (ii) Calculate the number of both conveyance and production Kanban cards needed for component B. Show your calculations. (Reminder of the basic formula: $K = D(LT)(1+X)/Q$). (6 of 8p)

i. Give an example of a situation where Temporary Kanban cards need to be added to a production system. (3 of 2p)

Question 2: The technical side of lean (17 of 28 points)

Nicholas defines the A3 Report as a simple one-page standardized document used in Toyota to report everything important about the analysis of the current situation (for example, in a production system) and the main conclusions drawn from such an analysis.

a.

(i) Indicate how the A3 report is divided, how the main sections of the A3 are named and, for each section, make an example of information or problem-solving tool or improvement tool typically reported (3 of 3p)

(ii) How does creating an A3 report fit into the PDCA cycle of improvement? (3 of 3p)

(iii) The A3 report is seen as a means to gain consensus from all parties involved (e.g., shop-floor employees, team leaders, supervisors), why? Motivate your answer with an example. (2 of 2p)

b. Company “Alpha” uses A3 reports. One of the company’s A3 reports shows that the “Alpha” production system is characterized by an OEE (Overall Equipment Effectiveness) equal to 60%.

(i) OEE is the result of the multiplication of three different performances. Name these three performances and, for each performance, provide an example of a source of production loss (e.g., equipment breakdowns). (0 of 4p)

(ii) Managers at “Alpha” realized that their approach to maintenance was poor since they were relying on maintenance staff only, without involving the equipment/shop-floor operators. Provide the name of the TPM pillar that specifically addresses the involvement of the equipment operators in maintenance activities. Further, discuss two typical maintenance practices/activities that directly involve equipment operators giving one example for each activity. (1 of 3p)

c. Explain the differences between a Machining Workcell and an Assembly Workcell. (2 of 3p)

d. As discussed in Lecture 3, a very high percentage of lean projects fail. Name and discuss four possible causes that can explain why lean projects fail. (1 of 5p)

e. (i) Explain why, in a company that works according to the principles of lean, the relationship with suppliers is particularly important. (ii) Mention three mechanisms that a company can employ to change a traditional buyer/supplier relationship into a partnership with suppliers which is more fitting to lean manufacturing. (5 of 5p)

Question 3: Binairy ordering (19 of 29 points)

POC Metal Production and Services B.V. ('POC') in Delfzijl, The Netherlands, is a supplier of metal components and currently produces and supplies the following:

- steel and aluminum aircraft components (steel: article number POS001, aluminum: article number POA001);
- two specialized components (patented by POC) made of steel for industrial gas-fired heating systems (article numbers POIH001A and POIH001B);
- components for road traffic signs, mainly steel plates (currently only article number POR001A) and steel frames (article number POF001A).

The production process currently has a functional lay-out. For the aircraft components (POS001 and POA001), the routing is as follows: first the metal is sawn (process: sawing), then the components are milled in the automated CNC workstation (process: milling) and then only the steel components (POS001) receive an additional treatment (process: steel protection). Finally, both types of components are assembled and packaged (process: assembly & packaging). The plates for road traffic signs (POR001A) are first cut out (process: cutting) and then the edges are bent (process: bending). They do not need manual assembly or packaging, because of a very efficient supply system with the customer. The steel frames (POF001A) undergo the following processes: sawing, milling, bending, steel protection and assembly/ packaging. The specialized components POIH001A and POIH001B undergo the following processes: sawing, cutting, bending and assembly & packaging. Even though these two components are made of steel, they do not require steel protection (the customer is of the opinion that that process is not necessary and therefore calls it 'waste').

Company policy is such that POC wishes to maintain flexible towards the market, and POC wishes to support a wide range of customers with many different requirements. POC claims that this provides a secure stream of business for the future. However, in recent years, particularly the specialized components POIH001A and POIH001B have done very well, because of strong demand from the customer, a major European player in the industrial heating market. Since these components are used in 'green' products, further growth in demand is expected.

Management of POC is considering to adopt a group production lay-out.

- a. Apply Binary Ordering to the described production situation to propose a group production lay-out. Clearly indicate and explain the steps that you take. If you need to make assumption(s), please do so and indicate the assumption(s). (13 of 15p)
- b. Propose, on the basis of the binary ordering outcome, a group structure. Again, if you need to make assumption(s), please do so and indicate the assumption(s). Include a flow chart for each group that you propose. (3 of 8p)
- c. Write a short proposal for the management of POC how they should organize their production processes. (3 of 6p)