TOM Problem Set # 6 (2025)

This problem set is designed to ensure you are well prepared to participate in the Shad Process Flow Design Exercise, a two-day simulation in which you will work in teams to design, implement, and improve a production process. Before working on this problem set, please carefully read the "Shad Process Flow Design" case.

For this problem set only: To ensure all students are individually prepared, students are not permitted to collaborate with classmates or ask the Teaching Fellows (TFs) questions about this problem set.

For all questions, assume that your customer plans to order units at the same pace and with the same product mix as described in the case.

1. What is the takt time required to meet your customer's needs for the Economy model?

    a. 30 seconds/unit
    b. 60 seconds/unit
    c. 90 seconds/unit
    d. 120 seconds/unit
    e. 150 seconds/unit
    f. 180 seconds/unit

    Answer: (b) The case states that the customer will place one order every 30 seconds, which equates to 120 orders per hour. The Customer Demand section of the case says, "The customer expects its order mix to average, within each hour, roughly one-half Economy, one-third Deluxe, and one-sixth Imperial models." Because half of the orders will be for Economy, customer demand for Economy is 60 units per hour, or 1 unit per minute. Thus, for the Economy model, the takt time—the cycle time necessary to meet customer demand—is 60 seconds per unit.

2. What is the takt time for the Imperial Model?

    a. 30 seconds/unit
    b. 60 seconds/unit
    c. 90 seconds/unit
    d. 120 seconds/unit
    e. 150 seconds/unit
    f. 180 seconds/unit

    Answer: (f) Per the solution to question 1, total customer demand is one unit every 30 seconds, and one-sixth of the customer's demand is for Imperial models. Thus, customer demand for Imperial will occur at an average rate of once every six cycles, or once every 6 cycles*30 seconds = 180 seconds. In other words, on average, demand for the Imperial

model is one unit per 180 seconds. The cycle time necessary to meet demand, takt time, is the reciprocal of that output rate, which is 180 seconds/unit.

Alternatively, consider one hour, where we scale the overall demand (1 unit per 0.5 minute) to units per hour as (1 unit/0.5 minute) * (60 minutes/ hour) = 120 units /hour. Only one sixth of this demand is for Imperial, which equates to 20 units / hour. Takt time is the cycle time necessary to deliver that output rate, and cycle time is the reciprocal of output rate, or 1 / (20 units/hour) = 1 hour/20 units = 60 min/20 units = 3 min per unit = 180 seconds per unit.

3. When can the demonstration team place orders for materials?

    a. During the first minute of each 3-minute block, including the setup phase from T=-6:00 to T=0.
    b. During the first minute of each 3-minute block, but only after T=0.
    c. Any time.

    Answer: (a). Orders for materials must be placed during the first minute of each 3-minute block. The demonstration team can place orders during the 9-minute set-up phrase as well as the simulation phase.

4. What happens to an out-of-sequence reject?

    a. It sits on the audit table until it is next in the sequence, at which point it is automatically accepted.
    b. It must be collected from the Out of Sequence Rejects buffer by the demonstration team, and routed through all audit processes again at the demonstration team's discretion.
    c. It must be collected by the demonstration team, but can skip visual and functional testing when the demonstration team decides to re-deliver it.

    Answer: (b). Out-of-sequence rejects, like other rejects, must be collected by the demonstration team. When the demonstration team decides to re-deliver an out-of-sequence reject, it must still pass through the visual and functional audit steps/

5. When the simulation ends, can additional units be accepted by the customer team?

    a. Yes, any unit that is currently being audited *or* in one of the unit-size buffers on the audit table can continue through the audit process and potentially be accepted.
    b. No, once the demonstration ends no more units can be accepted regardless of where they are in the process.
    c. Yes, any unit that the customer considers "finished goods" can be routed through the audit process and potentially be accepted.

    Answer: (a). Only units currently in an audit step, or being held in a buffer of size 1, can

continue through the audit process and be accepted by the customer after passing all audit steps. Even if the demonstration team's factory contains assembled breadboards that the demonstration team considers "finished goods," these breadboards cannot enter the audit process after the end of the simulation is announced, unless they were already being held in one of the three unit-sized buffers. The locations of the unit-sized buffers are shown in Exhibit 12 of the case—they are the "Deliver products here" buffer, the "Buffer for visual audit" and the "Buffer for pre-acceptance."

6. Is it safe to assume that, on the IC Chip and breadboard subassembly, the IC Chip will always be correctly installed on the breadboard?

    a. Yes.
    b. No.

    Answer: (b) No. The case says that the Demonstration team should perform quality inspections to ensure that the chips are installed on the breadboard with the correct orientation and position. If they are not, the unit might fail the functional and/or visual tests. If the Demonstration team finds that a chip is not positioned correctly, the team should reposition the chip to its correct location.

7. You're looking at a finished good, and it has a yellow LED light. What model is it supposed to be?

    a. Economy
    b. Deluxe
    c. Imperial
    d. All of (a) (b) and (c) are all correct

    Answer: (c). Only the Imperial includes a yellow LED. The case notes this in design specifications (Exhibits 1-3).