Operations management question

Business, Management

FALL 2011 2011 Deadline: October 26, Middle East Technical University – Northern Cyprus Campus BUS 361 Operations Management Homework 1 - Solutions 1. Fruit Computer Company manufactures memory chips in lots of ten chips. From past experience, Fruit knows that 80% of all lots contain 10% (1 out of 10) defective chips, 20% of all lots contain 50% (5 out of 10) defective chips. If a good batch (that is, 10% defective) of chips is sent on to the next stage of production, processing costs of $1000 are incurred, and if a bad batch (that is, 50% defective) is sent on to the next stage of production, processing costs of $4000 are incurred.

Fruit also has the alternative of reworking a batch at a cost of $1000. A reworked batch is sure to be a good batch. Alternatively, for a cost of $100, Fruit can test one chip from each batch in an attempt to determine whether the batch is defective. Determine how Fruit can minimize the expected total cost per batch. Expected total cost per batch = $1580. Fruit can minimize the expected total cost per batch by choosing the following decisions: It should test a chip.

If the tested chip is defective, Fruit should rework the batch. If the tested chip is not defective, however, Fruit should send batch on to the next stage. See the following figure for details. Probabilities regarding testing a chip are calculated as follows. D: Chip is defective, D': Chip is not defective, BB: Bad Batch, GB: Good Batch P(GB) = 0. 8, P(BB) = 0. 2, P(D | GB) = 0. 1, P(D' | GB) = 0. 9, P(D | BB) = 0. 5, P(D' | BB) = 0. 5, P(D) = (0. 8)(0. 1) + (0. 2)(0. 5) = 0. 18, P(D') = 1 – P(D) = 0. 82

P(GB | D) = (P(D| GB) P(GB) + P(D| BB)P(BB)) / P(D) = 8/18 P(BB | D) = 1 – P(GB | D) = 10/18 P(GB | D') = (P(D'| GB) P(GB) + P(D'| BB)P(BB)) / P(D') =

72/82 P(BB | D’) = 1 – P(GB | D’) = 10/82 1 2. A retailer of electronic products has asked a particular manufacturer to begin daily deliveries rather than on a weekly basis. Currently the manufacturer delivers 2000 cases each Monday. The cost of each case is valued at $300. a. What is the average inventory (in units)? b. The average inventory (in dollars)? c. What is the inventory turnover? . What is the average inventory (in dollars) for the daily delivery pattern, assuming 20 days/month? a. Average inventory = (2000 + 0) / 2 = 1000 units. b. Average inventory = 300 * 1000 = $300, 000 c. Inventory turnover = Net sales / Average Inventory = 52 * 2000 / 1000 = 104 d. Average inventory = (2000/5 + 0) / 2 = 200 units Average inventory = 300 * 200 = $60, 000 3. METU NCC Student Affairs officer, Sinem, is checking the accuracy of student registrations each day. For each student this process takes exactly two and a half minutes.

There are times when Sinem gets quite a backlog of files to process. She has argued for more help and another computer, but her manager doesn’t think capacity is that stressed. Use the following data to determine the utilization of her and her computer. She works seven and a half hours per day (she gets 30 minutes off for lunch), 5 days per week. What is the utilization of Sinem and Sinem’s computer? The following data are fairly typical for a week: 3 Total number of files to process = 70 + 150 + 130 + 120 + 160 = 630 Time it takes Sinem to process the files in each week = 630 files * 2. min/file = 1575 minutes. Total working hours available in a week = 7. 5 hours/day * 5 days = 7. 5 * 5 = 37. 5 hours = 37. 5 * 60 minutes = 2250 minutes / week Utilization = Actual working time / Time available = 1575 / 2250 = 70% 4. Consider the following three-station production line with a single product

that must visit station 1, 2, and 3 in sequence: • Station 1 has 4 identical machines with a processing time of 15 minutes per job. • Station 2 has 10 identical machines with a processing time of 30 minutes per job. Station 3 has 1 machine with a processing time of 3 minutes per job. a. What is rb (bottleneck rate) for this line? b. Can this system satisfy the daily demand of 180 units (assume 2 shifts in a day, and 4 hours in a shift)? c. What is T0 (raw processing time) for this line? d. What is W0 (critical WIP) for this line? Station 1 Production rate (jobs/min) Production rate (jobs/day) = 128 Station 2 Station 3 = 160 = 160 a. Station 1 is the bottleneck station, which has bottleneck rate, rb = 4/15. b.

Because the bottleneck station’s production rate of 128 is less than the daily demand of 180 units, this system cannot satisfy the daily demand. 4 c. T0 = 15 + 30 + 3 = 48 minutes. d. W0 = rb * T0 = 4/15 * 48 = 12. 8 13 units. 5. The final assembly of Noname PCs requires a total of 12 tasks. The assembly is done at the Lubbock, Texas plant using various components imported from Far East. The tasks required for the assembly operations, task times and precedence relationships between tasks are as follows: Task Task Time (min)

Immediate Predecessors 1 2 2 2 2 3, 4 7 5 6, 9 8, 10 11 Positional Weight 70 58 31 27 20 29 25 18 18 17 13 7 Rank 1 2 3 4 5 6 7 8 9 10 11 12 12 6 6 2 2 12 7 5 1 4 6 7 1 2 3 5 7 4 6 8 9 10 11 12 Given that the company produces one assembled PC every 15 minutes, a. Assign tasks to workstations using the Ranked Positional Weight Algorithm. b. Calculate balance delay and workload imbalance for your solution. c. Evaluate optimality of your solution (in terms of number of workstations, balance delay and workload imbalance). 5 a. Order of tasks: 1, 2, 3, 6, 4, 7, 5, 8, 9, 10, 11, 12

WS 1 1 15 3 WS 2 2, 3, 4 15 9 3 1 WS 3 6, 5, 9 15 3 1 0 WS 4 7, 8 15 8 3 WS 5 10, 11 15 11 5 WS 6 12 15 8 Thus, the number of workstations found by RPW heuristic is equal to 6. ? b. Balance Delay (D) = b1= 3, b2= 1, b3= 0, b4= 3, b5= 5, b6= 8 ? = 20/6 = 3. 33, Workload Imbalance (B) = v c. Lower bound on number of workstations = [ ] [?] =[ ] LB[D] = 0, LB[B] = 0. None of the lower bounds are equal to the obtained objective values (K*, D, B). Thus, we do not know whether the solution obtained by RPW heuristic is optimal or not. 6