

Q.1: The Warehouse Company supplies spare parts for its two plants, Plant A and Plant B. Plant A and Plant B do not have any significant storage space. Hence you want carry minimum possible inventory at the plants A, B. The warehouse W stocks two types of spare parts, part # A for the Plant A and part # B for the Plant B. The Warehouse Company uses a state of the art automated retrieval system (ARS) to retrieve parts from storage in the warehouse.

Part # A: The retrieval system takes one minute/unit to retrieve and send the part to the loading dock.

Part # B: The retrieval system takes one minute/unit to retrieve and send the part to the loading dock.

Whenever the retrieval system has to switch from part # A to part # B, there is a "dead loss" of 30 minutes.

Whenever the retrieval system has to switch from part # B to part # A, there is a "dead loss" of 30 minutes.

The demand for A at the Plant A is deterministic and is 15units /hr or 360units/day.

The demand for B at the Plant B is deterministic and is 15units /hr or 360units /day.

Assume, day=24hrs. Thus, Plant A, Plant B, and the Warehouse Company are all open round the clock.

Plant A and Plant B and the Warehouse Company are all located in Houston, and hence the transportation time from the loading dock of the Warehouse Company to the plants is negligible.

The goal is to use the ARS efficiently so as to keep the plants busy as much as possible.

Design a scheme to use the ARS efficiently. Specifically,

How many units of part A will be retrieved and shipped before you switch to part B?

How many units of part B will be retrieved and shipped before you switch to part A?

Q.2: Nation -Wide Bus Lines (NWBS) conducts training classes for new drivers. The classroom can hold 35 students. As long as the class size is less than or equal to 35, the training program costs \$22,000 per class. Ignore the time consumed in training. After completing the training program, drivers are paid \$1,600 per month stipend until a full-time driver position is open. After trained driver begins the job, the driver is paid a regular salary of \$4000 per month. The NWBS needs 5 new drivers per month. Goal is to minimize the total cost(training cost + stipend).

How large should the training classes be?

How many training classes should the company hold each year?

What is average waiting time for a trained driver=

(waiting time= time between training completion & new job beginning date)

Q.3: Consider a community dining style restaurant such as Benihana of Tokyo.

Assumptions are as follows:

When you admit a customer to the bar, the customer is assured a seat in the bar for 30 minutes (15 minutes a drink, 2 drinks). Each dining table seats 8 people. As soon as a dining table is empty, a group of eight who have spent 30 minutes in the bar is assembled in the bar and is taken to the dining table by a hostess. These 8 people spend 90 minutes at the dining table. Thus, if a group of 8 people start dinner at 6:30PM, they will all be done at 8:00PM. Consider a steady state system. Assume that the restaurant is open for 24 hours. Also assume (i) a large inventory of people who are eager to get in to the bar (ii) there is no set up time lost in assembling 8 people in the bar or in the dining hall. Answer the following questions. Assume steady state.

Design x: **Restaurant Bar Space=8 people**
 Dining Tables=4

Restaurant Capacity (dinners served per day, day=24hrs) =

Design y: **Restaurant Bar Space=16 people**
 Dining Tables=4

Restaurant Capacity (dinners served per day, day=24hrs) =

Q.4 Cookie company is open for all day and night, 24 hrs. Enough demand exists to keep the cookie company busy 24 hrs.

(A) Assume you have (i) one oven which can accommodate one tray of one dozen cookies at a time (ii) unlimited # of trays each of which can hold one dozen cookies (iii) unlimited # of bowls which can accommodate mixing of dough for up to two dozen cookies at a time, and (iv) large counter space for cooling. Assume that each customer orders 2 dozen unique cookies. For example, Customer1 (C1) orders two dozens of chocolate chip, C2 orders two dozens of mint, C3 orders two dozens of peanut butter,...etc. Thus, an order consists of making two dozen cookies.

You: Mix dough according to customer's specifications, 6 minutes per order.

You: Spoon the dough, 2 minutes per dozen.

Place the tray in the oven, set the timer, and place the tray on the counter when it is baked (ignore the time required for these activities).

One dozen takes 10 minutes to bake in the oven.

Cool: 5 minutes on the counter.

Bob, the Room Mate: Pack and receive payment, 3 minutes per order

Throughput time per order, $T =$ minutes

Capacity per hr, $R =$ orders/hr

B) Suppose that the oven can hold two trays of one dozen cookies each at a time. Rest of the assumptions are same as in (A).

Throughput time per order, $T =$ minutes

Capacity per hr, $R =$ orders/hr

Q.5 Wood County Hospital consumes 400 boxes of bandages per week. The price of bandages is \$80 per box, and the hospital operates 52 weeks per year, 7 days a week. The cost of processing an order is \$64 and cost of capital is 20% (cost of carrying \$1 worth of inventory for one year is \$0.20).

(i) Best $Q =$

(ii) Average time a box of bandage is stored in the warehouse =

Q.6: Pennsylvania Star Insurance Co (PSI) specializes in automobile insurance business. The management of its claims department is preparing hiring plans for the next year, particularly the ideal staffing level for claims representatives (who are called "claims reps" for short). Based on the past and the planned future sales of insurance policies, PSI forecasts the new claims arrival rate to be about 10,000 claims per quarter during the next four quarters (i.e. one year). The claims department has determined that a claims rep needs to perform four hours of claims handling work per claim to close a claim.

Define, age of a claim = claim closing date - date on which the claim "arrived" at PSI.

The PSI promises that average age of claims to be six months (=two quarters).

Each claims rep is available for 1600 hrs per year (or 400 hours/quarter). The company desires to achieve a claims' closing rate that is equal to the new claims arrival rate (i.e. 10,000 claims per quarter).

a) How many claims reps should PSI employ next year?

b) What average level of pending claims (i.e. number of open claims) may PSI expect at any point in time during the coming year? Note that this is an ongoing, not a startup, operation.

c) What caseload (average number of pending claims per claims rep) will the claims reps experience?

Q.7: The Houston Consulting consists of associates, managers, and partners. The company would like to maintain 200 associates, 60 managers, and 20 partners. After four years of working as associate, an employee moves up as manager or out. After six years of working as manager, a manager either becomes a partner or out. A partner stays with the company for another ten years (a total of 20 years with the company). The company recruits MBAs as associates; no new hires are made at other levels.

How many new MBAs does the company have to hire every year?

What is the probability that a new hire at the company will become Partner (as opposed to being dismissed after 4 or 10 years)?

Q. 8: Consider drilling operation similar to the one you have seen in Donner case. You have two choices for drilling. **Auto Route, Manual Route**
 X =order size(# of boards in an order). Setup and run times are given below. Labor is not a constraint. Factory is open 24 hrs.

	Setup time (per order)	Run time (per hole)
Manual	20 min	0.06 min
Auto	300 min	0.004 min

(A) You are an "expediter." Your objective is to rush the order through the drilling stage. (Objective is to minimize the delivery time). **Auto Route: 1 CNC** machine available, **Manual Route: 5 machines available; 500 holes per board**

(i) Using break even analysis, provide your recommendation as to when to use the Auto route.

(ii) Suppose $X=35$, and suppose you are using **manual** route.

Average (set up + run) time per board=

If the setting up of the machine(s) starts at 9:00 am, when will the order get out of drilling stage?

(B) Suppose **Auto Route: 2 CNC** machine, **Manual Route: 5 machines**; 500 holes per board.

Objective is to maximize productivity (maximize, capacity = the # of boards drilled per day).

(i) Using break even analysis, provide your recommendation as to **when to use** Auto route.

(ii) Suppose $X=35$, and you are using auto route.
Compute:

Average (set up + run) time per board =