

IEOR 153 Midterm Examination Solutions

Spring 2013, Prof. Leachman.

Closed book and notes. Calculators are allowed. Print your name and student ID number on your test and also on any separate pages that you turn in.

1. Circle T for true or F for false or do not circle. Two points for a correct answer, minus four points for an incorrect answer, zero points for no circle. (20 points possible.)

- (a) (T) Changing to a vendor-managed inventory system often leads to increased administrative and transportation expenses for the supplier.
- (b) (T) In a supply chain with uncertain demand where the manufacturer makes to stock, if the manufacturer has no information about potential sales except information received from the retailer, then the retailer has an incentive to inflate the sales forecast.
- (c) (F) Consider a product with uncertain one-time demand that costs \$30 per unit to purchase, sells for \$40 per unit, and has a salvage value of \$10. If our goal is to maximize expected profit, we should order more than the average demand for the product.
- (d) (F) Transportation costs for a large firm typically increase when the company changes from direct shipping to handling goods through intermediate warehouses.
- (e) (F) If the boundary between make-to-stock and make-to-order is shifted upstream in the supply chain, inventory costs typically will be increased.
- (f) (F) For goods shipped weekly with a lead time of 4 weeks, a standard deviation of weekly demand equal to half the weekly demand, and safety stock set to provide a 98% service level, the safety stock will be smaller than the average cycle stock.
- (g) (T) Introduction of an options contract enables the retailer to reduce its risk of a supply shortage and it encourages the manufacturer to generate more supply.

- (h) (F) When a supplier makes to stock in advance of uncertain demand, the total supply chain profits can be moved closer to the global optimum if the contracts with retailers include a buyback provision.
- (i) (T) If sales promotions (temporary price cuts) are eliminated, the bullwhip effect can be reduced.
- (j) (F) Vendor-managed inventory is an important innovation but it does little to mitigate the bullwhip effect.

2. Sport Obermeyer needs to place orders for its winter parkas with its suppliers in China and Hong Kong. The total budgeted production for next season is 20,000 parkas. Orders for 10,000 must be placed now, and orders for the remaining 10,000 may be placed next March after improved forecasts are available. Forecasts available now for next season's sales in the various parka styles are as follows:

Style	Forecast	Standard deviation of forecast error
Gail	1,017	194
Isis	1,042	323
Entice	1,358	248
Assault	2,525	340
Teri	1,100	381
Electra	2,150	404
Stephanie	1,112	524
Seduced	4,017	556
Anita	3,296	1,047
Daphne	2,383	697
Totals	20,000	4,714

- (a) (20 points) How many of each style do you recommend should be ordered now? Provide formulas or explain your method.

We wish to subtract 10,000 parkas. It is best to equalize risk of overstocks. So we should scale the standard deviations by a factor of $10,000/4,714 = 2.1213$, i.e., we can subtract a bit more than two standard deviations of forecast error from the forecasts to obtain initial order quantities:

$$\begin{aligned} \text{Gail} & 1,017 - 2.1213 \cdot 194 = 605 \\ \text{Isis} & 1,042 - 2.1213 \cdot 323 = 357 \\ \text{Entice} & 1,358 - 2.1213 \cdot 248 = 832 \\ \text{Assault} & 2,525 - 2.1213 \cdot 340 = 1,804 \end{aligned}$$

Teri $1,100 - 2.1213 \cdot 381 = 292$
 Electra $2,150 - 2.1213 \cdot 404 = 1,293$
 Stephanie $1,112 - 2.1213 \cdot 524 = 0$
 Seduced $4,017 - 2.1213 \cdot 556 = 2,838$
 Anita $3,296 - 2.1213 \cdot 1,047 = 1,075$
 Daphne $2,383 - 2.1213 \cdot 697 = 904$

Total = 10,000.

- (b) (20 points) Suppose production can be sourced from Hong Kong at \$60 per parka and from inland China at \$52 per parka. The Hong Kong supplier requires a minimum order quantity (computed as the sum of the amount ordered now plus the second amount ordered in March) of 600 for any style. The inland China supplier requires a minimum order quantity of 1,200 for any style. If 5 styles have to be sourced from China, which ones would entail the least amount of risk of overstock? If 5 styles have to be sourced from Hong Kong, which ones would entail the greatest amount of reduction in the risk of overstock (compared to sourcing from China)? Again, explain your reasoning.

Let's express the minimum order quantities in terms of z -factors so we can gauge the risks of overstocks:

Style	z -factor for Hong Kong order	z -factor for China order
Gail	$(600 - 1,017)/194 = -2.15$	$(1,200 - 1,017)/194 = 0.94$
Isis	$(600 - 1,042)/323 = -1.37$	$(1,200 - 1,042)/323 = 0.49$
Entice	$(600 - 1,358)/248 = -3.06$	$(1,200 - 1,358)/248 = -0.64$
Assault	$(600 - 2,525)/340 = -5.66$	$(1,200 - 2,525)/340 = -3.90$
Teri	$(600 - 1,100)/381 = -1.31$	$(1,200 - 1,100)/381 = 0.26$
Electra	$(600 - 2,150)/404 = -3.84$	$(1,200 - 2,150)/404 = -2.35$
Stephanie	$(600 - 1,112)/524 = -0.98$	$(1,200 - 1,112)/524 = 0.17$
Seduced	$(600 - 4,018)/556 = -6.15$	$(1,200 - 4,018)/556 = -5.07$
Anita	$(600 - 3,296)/1,047 = -2.57$	$(1,200 - 3,296)/1,047 = -2.00$
Daphne	$(600 - 2,383)/697 = -3.42$	$(1,200 - 2,383)/697 = -1.70$

There is little risk of an overstock in sourcing Assault, Electra, Seduced, Anita and Daphne from China, so we should source those from China to take advantage of the lower unit cost. But there is a lot of risk sourcing Gail, Isis, Teri and Stephanie from China, so we should source those from Hong Kong. That leaves Entice. Assuming overstock costs are comparable to the \$8 unit cost savings, it is probably best to source Entice from Hong Kong and avoid that risk.