Quiz 4

1. Consider a supply chain for winter coats where A sells to B who sells to customers. Demand is uniformly distributed between 200 and 400 units. B sells at a price of $400 per unit. A sells to B at $300 per unit. The cost per unit at A is $240 per unit. Assume the product is a fashion good and so newsvendor assumptions hold. Further, if B has any unsold items at the end of the selling period, they get a salvage value of $100 per unit. Determine the buy-back price from A that would coordinate the supply chain (*note: there is no need to compute profits, so don't worry about any payment from B to A*).

If act in a centralized way: $P = 400$

$C = 240$

critical ratio $= \dfrac{400 - 240}{400 - 100} = .53$ $S = 100$

so set $\dfrac{400 - 240}{400 - B} = .53$ $\rightarrow B = \$98.11)$

2. Explain in words what *postponement* is.

waiting until the last possible moment to differentiate product for specific customers.

(The HP printer example we discussed in class is postponement)

Quiz 5

1. Consider the ~~case~~ costs where market demand is given by P=100-2Q for 2 firms (and q1+q2=Q). Marginal ~~case~~ cost for firm 1 is $2 and firm 2 is $4. If this is a Stackelberg game with Firm 2 as the leader, determine the best response function for firm 1 (please write it out fully).

for firm 2: $\Pi_2 = (100 - 2(q_1 + q_2))q_2 - 4q_2$

$\Pi_2' = 100 - 2q_1 - 4q_2 - 4 \equiv 0$

$\rightarrow q_2 = \dfrac{96 - 2q_1}{4}$

so

$R_1 = \Pi_1(q_1) = \left(100 - 2\left(q_1 + \dfrac{96 - 2q_1}{4}\right)\right)q_1 - 2q_1$

2. For the following 2-person game, determine the Nash equilibria (if any). In addition, identify outcomes that are Pareto improving (if any) over outcome (A1,A1).

	A1	A2
A1	(5,4)	(4,5)
A2	(6,2)	(3,3)

In this case (A1, A2) is a NE (the only one). There are no Pareto improving outcomes for it.

Name __Key__

Quiz 6

1. A restaurant owner wants to hire a waiter for tonight's shift. She can't observe the waiter's effort (high, medium, or low), but she knows she will make revenues of either $1000 or $300 for the four-hour shift based on past experience. She wants to hire Bob, but Bob has an offer from the competition that gives him a utility of $90. If Bob works with high effort then the restaurant earns $1000 60% of the time; if he works with medium effort then the restaurant earns $1000 47% of the time, and if he works with low effort, the restaurant earns $1000 20% of the time. Write the optimization problem from the owner's perspective, assuming she wants the waiter to work hard. Make sure and define your variables.

o turns

Effort		1000	300
	High	.6	.4
	med	.47	.53
	Low	.2	.8

$$\min \quad .6w^H + .4w^L$$

s.t.

$$.6w^H .4w^L - e^H \geq 90$$

$$.6w^H + .4w^L - e^H \geq .47w^H + .55w^L - e^M$$

$$.6w^H + .4w^L - e^H \geq .2w^H + .8w^L - e^L$$

$$w^H, w^L \geq 0$$

2. For problem 1, suppose the owner offers a contract of $100 if Bob accepts, and a bonus payment of B if the restaurant outcome is $1000. Reformulate the owner's optimization problem.

$$\min \quad B + 100$$

s.t.

$$.6B + 100 = 90$$

$$.6B + 100 - e^H \geq 90$$

$$.6B + 100 - e^H \geq .47B + 100 - e^M$$

$$.6B + 100 - e^H \geq .2B + 100 - e^L$$

$$B \geq 0$$

Quiz 6

1. Stevesbees is a new startup firm that makes honey-based cosmetics. They will sell their product through specialty stores, and they need to hire a distributor. The distributor will manage the inventory and shipping and has regularly used two carriers (C1 and C2) to ship for them. The carriers have varying levels of on-time delivery (probabilities shown in the table below). Steevesbees wants to contract with the distributor and for the distributor to choose carrier C1. They will pay the distributor monthly. However, they cannot directly control which carrier the distributor uses. They are in regular contact with the specialty stores, however, and can get feedback on the service level actually provided.   The cost to the distributor to handle the demand for Stevesbees is $60,000 if they use C1 and $50,000 if they use C2.   Further, they won't take the job unless they receive at least $80,000 from Stevesbees. Develop a contract for Stevesbees to offer. Show the formulation and explain each part. Next, solve for the contract (it is simple enough in this case to do by hand).

Carrier	95% on time	75% on time
C1	0.8	0.2
C2	0.4	0.6

$\min \quad .8\,w^H + .2\,w^L$

$\text{s.t.} \quad .8\,w^H + .2\,w^L - 60{,}000 \geq 80{,}000 \quad (\text{participation})$

$.8w^H + .2w^L - 60000 \geq$
$\qquad .4w^H + .6w^L - 50000 \quad (\text{incentive compat})$

$.8\,w^H + .2\,w^L \geq 140000$
$.4\,w^H - .4\,w^L \geq 10{,}000 \quad \Rightarrow \quad w^H = w^L + 25000$

so

$-8(25000 + w^L) + .2\,w^L \geq 140000$

$\Rightarrow w^L = 120000$

$w^H = 120000 + 25000 = 145000$