Final

QUESTION 1

There are drawbacks of having consistent demand. Consistent demand is when a product sells at a uniform rate throughout the year, meaning it is independent of the season. As a result, the production of the product needs to be consistent throughout the year. This could cause problems for the firm if the product is more easily made during a specific time, or similarly, harder to produce during a certain season. For example, assume the COVID-19 vaccines such as ones developed by Pfizer and Moderna will be in consistent demand throughout the year. In this case, issues arise in the transportation of these vaccines throughout the world, as factors such as environmental extremes, i.e., harsh winters, and clashes between countries, affect its ability to be distributed evenly and appropriately to different places.

Final

QUESTION 2

Single period model is a model where goods typically cannot be held over to the next period, and when they can they incur significant price reductions. Therefore, the objective is to choose an order quantity that will minimize shortage and excess costs. The service level (SL) is the probability that demand will not be greater than the quantity of goods on hand:

$$SL = \frac{C_S}{C_E + C_S}$$

Where C_S is shortage costs and C_E is excess costs. A higher service level affects the optimal stocking policy in single period inventory model because since goods cannot be held over to the next period, then there will be more shortage costs to account for. In the case of a lower service level, there is less shortage costs, and thus, more revenue for the company.

Final

QUESTION 3

The bullwhip effect is when demand/order variability gets progressively larger the further back in a supply chain is the company. This effect is caused by the isolation of manufacturing from the retail sector, errors in forecasting, promotional pricing, and the trade show effect. The implications include a strain on manufacturing capacity, rescheduling, increased inventory holdings, and shelf-life issues. Therefore, two remedies to the bullwhip effect are:

1. Make product to order.
2. Increase inventories.

Final

QUESTION 4

$\overline{d} = 20\ canisters/day$

$\sigma_d = 4\ canisters/day$

$\overline{LT} = 8\ days$

$\sigma_{LT} = 2\ days$

$E(z) = 2\%$

$ROP = ?$

$E(z) = 2\% \rightarrow E(z) = 0.02$

Using Table 12-3, given that $E(z) = 0.02$, then this means that $z \cong 1.66 = 1.66$.

Now, calculate ROP, using the equation where both demand and lead time are variable:

$$ROP = \overline{d} \cdot \overline{LT} + z\sqrt{\overline{LT}\sigma_d^2 + \overline{d}^2\sigma_{LT}^2}$$

$$ROP = 20 \cdot 8 + 1.66\sqrt{8(4)^2 + (20)^2(2)^2}$$

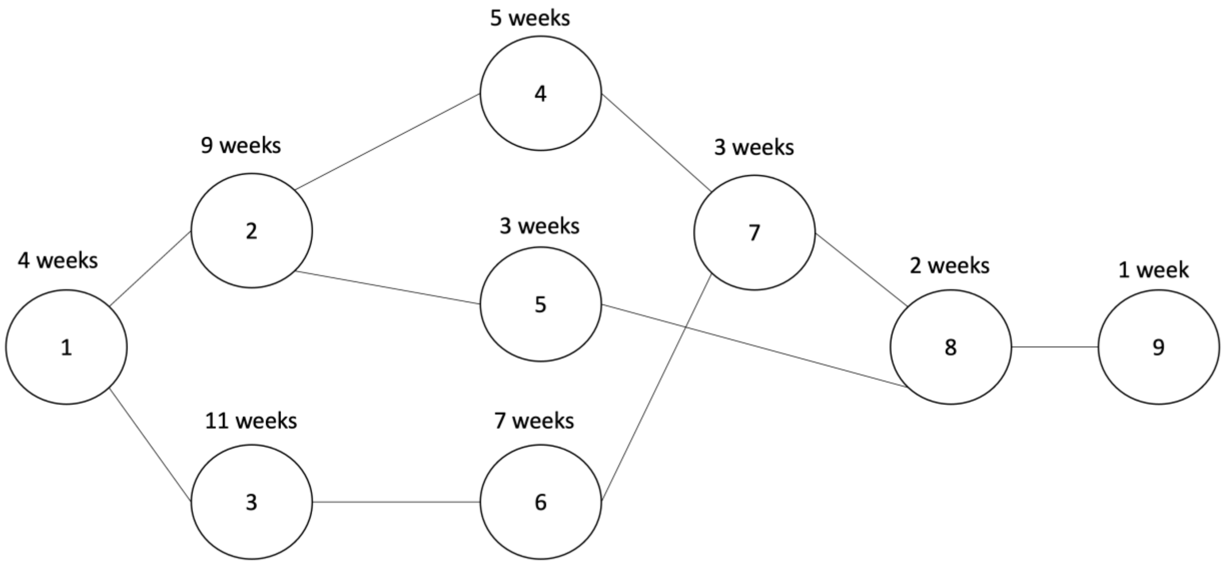
$$ROP = 229$$

The reorder point for these canisters is 229.

Final

QUESTION 5

a) Critical path and slack times.



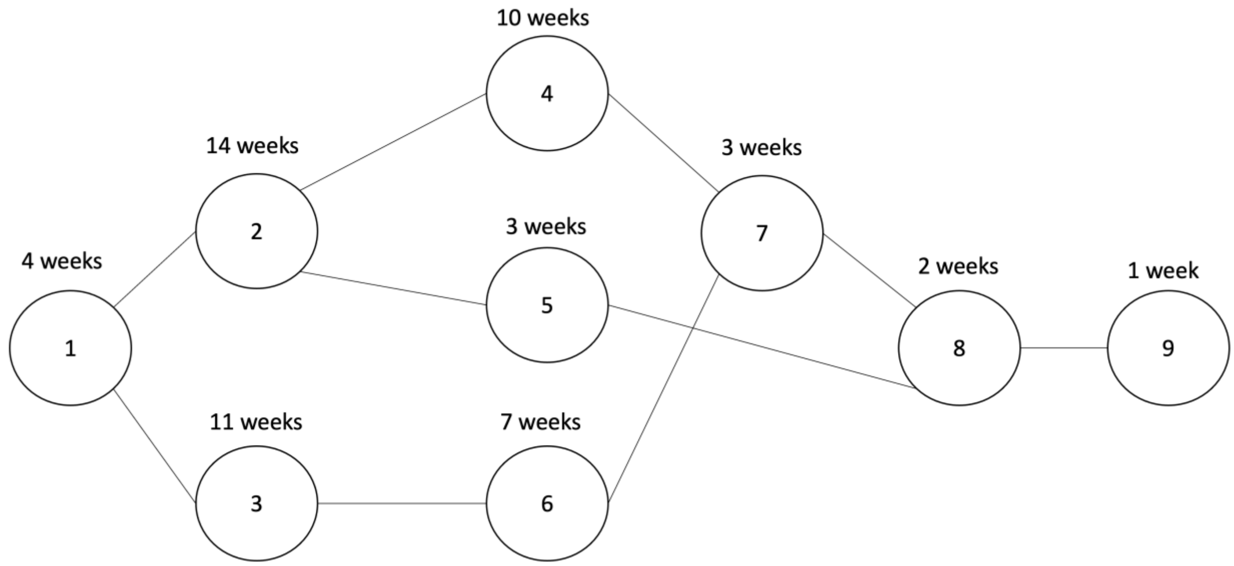
Note: All paths go from left to right.

Path	Length (weeks)	Path Slack (weeks)
$1-2-4-7-8-9$	$4+9+5+3+2+1=24$	$28-24=4$
$1-2-5-8-9$	$4+9+3+2+1=19$	$28-19=9$
$1-3-6-7-8-9$	$4+11+7+3+2+1=28$	$28-28-0$

Critical path: $1-3-6-7-8-9$.

Final

b) If activity 2 and 4 took 5 extra weeks.



Path	Length (weeks)	Path Slack (weeks)
$1-2-4-7-8-9$	$4+14+10+3+2+1=34$	$34-34=0$
$1-2-5-8-9$	$4+14+3+2+1=24$	$34-24=10$
$1-3-6-7-8-9$	$4+11+7+3+2+1=28$	$34-28-6$

Critical path: $1-2-4-7-8-9$.

The critical path changes to $1-2-4-7-8-9$.

Final

QUESTION 6

$D = 90\ units/year$

$H = 1.5R$

$S = \$3$

$EOQ_{R=\$5} = \sqrt{\frac{2DS}{iR}} = \sqrt{\frac{2(90)(3)}{1.5(5)}} = 8.49$ or 9 units. $9 < 100$, EOQ is not feasible.

$EOQ_{R=\$5.5} = \sqrt{\frac{2(90)(3)}{1.5(5.5)}} = 8.09$ or 8 units. $8 < 50$, EOQ is not feasible.

$EOQ_{R=\$6} = \sqrt{\frac{2(90)(3)}{1.5(6)}} = 7.75$ or 8 units. $0 < 8 < 100$, EOQ is feasible.

Next, need to compare total cost of $Q = 8$ units with those of $Q = 50$ and $Q = 100$.

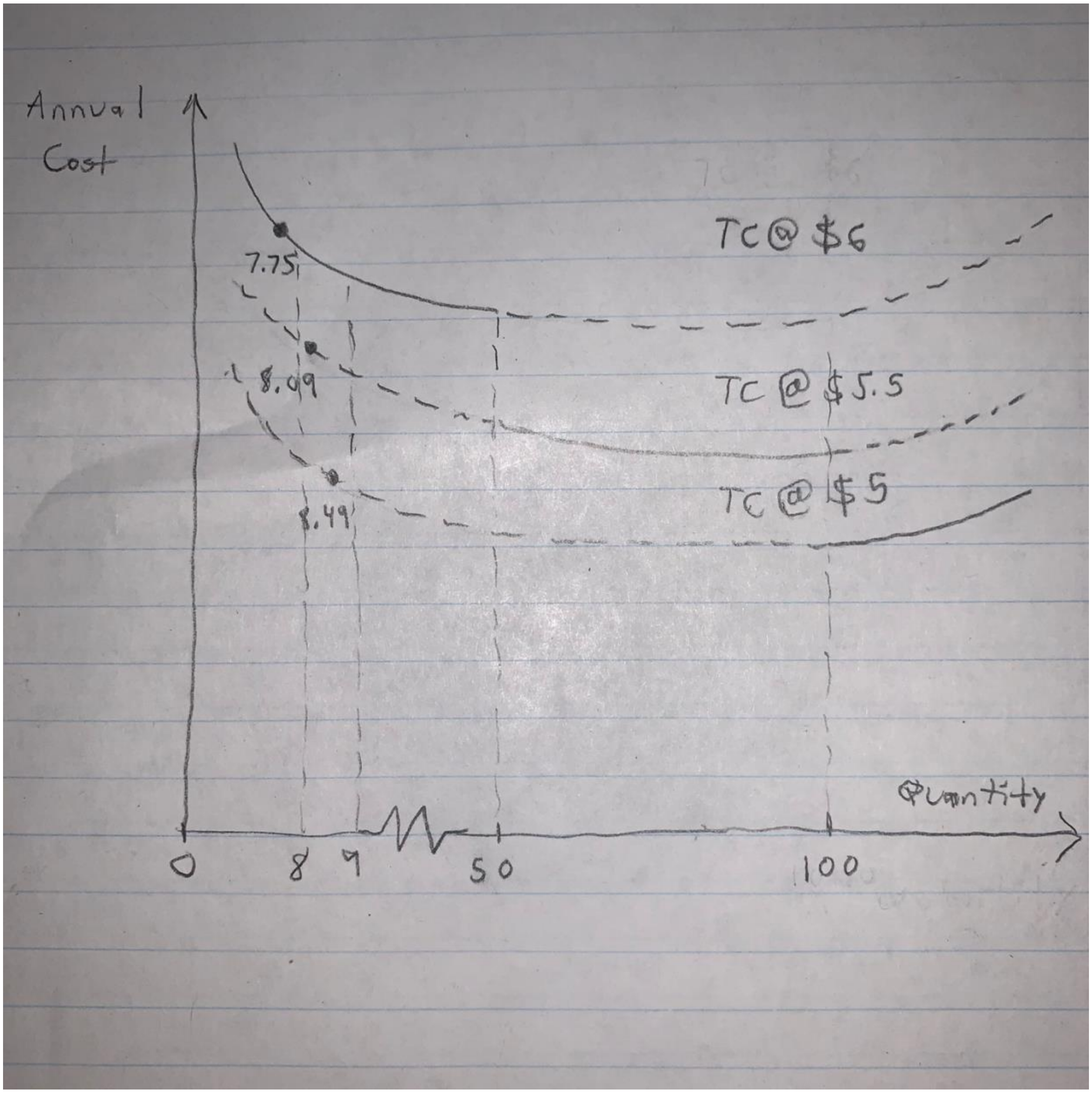
$$TC_8 = \frac{Q}{2}H + \frac{D}{Q}S + RD = \frac{8}{2}(1.5)(6) + \frac{90}{8}(3) + 6(90) = \$609.75$$

$$TC_{50} = \frac{50}{2}(1.5)(5.5) + \frac{90}{50}(3) + 5.5(90) = \$706.65$$

$$TC_{100} = \frac{100}{2}(1.5)(5) + \frac{90}{100}(3) + 5(90) = \$827.70$$

Therefore, the order quantity that will minimize total cost is indeed 8 units.

Final



As shown in the conceptual graph, the optimal order quantities on the $5.5 and $5 lines are infeasible, thus, the quantity on the $6 line is used.

Final

QUESTION 7

4 hours to produce a unit → 40 hours per week per worker → 100 workers → 1,000 regular.

Month		1	2	3	4	5	6	7	8	9	10	11	12	Total
Forecast		9,000	7,000	5,000	4,000	2,000	1,500	1,000	1,200	1,600	3,000	5,700	7,000	48,000
Output														
Regular		0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Part Time														0
Overtime		0	1,000	1,000	1,000	1,000	500	0	200	600	1,000	1,000	1,000	9,300
Subcontract		0	5,000	3,000	2,000	0	0	0	0	0	1,000	3,700	5,000	26,700
Output – Forecast		-9,000	0	0	0	0	0	0	0	0	0	0	0	0
Inventory														
Beginning		9,000	0	0	0	0	0	0	0	0	0	0	0	
Ending		0	0	0	0	0	0	0	0	0	0	0	0	
Average		4,500	0	0	0	0	0	0	0	0	0	0	0	4,500
Backorder		0	0	0	0	0	0	0	0	0	0	0	0	0
Costs														
Regular	$300	$0	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$360,000
Part Time														
Overtime	$360	$0	$36,000	$36,000	$36,000	$36,000	$18,000	$0	$7,200	$21,600	$36,000	$36,000	$36,000	$298,800
Subcontract	$420		$210,000	$126,000	$84,000						$42,000	$155,400	$210,000	$827,400
Hire/Layoff	$500													$0
Inventory	$10	$45,000												$45,000
Backorders														
														$1,531,200

Total cost $= \$1{,}521{,}200$.

Final

QUESTION 8

P:

Week	Beginning Inventory	1	2	3	4	5	6	7	8
Quantity								400	

P:

Item P LT = 1 week	Beginning Inventory	1	2	3	4	5	6	7	8
Gross Requirements								400	
Schedule Receipts									
Projected On-Hand									
Net Requirements								400	
Planned-Order Receipts								400	
Planned-Order Releases							400		

B:

Item B LT = 1 week	Beginning Inventory	1	2	3	4	5	6	7	8
Gross Requirements							400		
Schedule Receipts									

Projected On-Hand							0		
Net Requirements							400		
Planned-Order Receipts							450		
Planned-Order Releases						450			

D:

Item D **LT = 2 weeks**	**Beginning Inventory**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Gross Requirements						900			
Schedule Receipts			80						
Projected On-Hand	50				130	130			
Net Requirements						770			
Planned-Order Receipts						770			
Planned-Order Releases				770					

The amount for the planned-order releases of D in Week 3 is 770.