Question 1

A home appliance manufacturer considers two suppliers, Atlanta Electronics and ElectroTech, for one of the main components that goes into its products. Atlanta Electronics sells the component for $0.6 per unit, if the order quantity is less than 500, for $0.58 per unit, if the order quantity is between 500 and 999, and for $0.56 per unit, if the order quantity is at least 1000. Electrotech charges $0.62 for the first 500 units, $0.56 for additional units between 500 and 1000, and $0.54 for additional units above 1000.

The cost of placing an order is $20, and the annual demand for this component is 800 units. Inventory carrying cost is estimated to be 20% annually. Shortages are not allowed.

(a) (4 points) What kind of quantity discount model is offered by each supplier? Incremental or all-units?

(b) (13 points) Calculate the optimal order quantity if the manufacturer chooses to order from Atlanta Electronics. What is the average annual total cost (ordering + holding + purchasing) in this case?

(c) (13 points) Calculate the optimal order quantity if the manufacturer chooses to order from Electrotech. What is the average annual total cost in this case?

Question 2

A small local retailer sells solvents at a steady rate of 500 gallons per year. The cost of placing an order for the solvent from the supplier is $50, and each gallon costs $2. Inventory holding cost is 20% annually. If the demand exceeds inventory, excess demand is backlogged (i.e., satisfied later on), but there is a penalty of $0.3 per gallon short per year.

(a) (5 points) What is the optimal order quantity?

(b) (6 points) What is the cycle time (time between two orders)? What is the length of time in each cycle with positive inventory? What is the length of time in each cycle with negative inventory?

(c) (2 point) What is the maximum amount of shortages at any time?

(d) (2 points) What is the average annual total cost?