Assignment 2

Due on 5/29 1 p.m.

Q1. (20%)

An auto manufacturer uses 500 tons of steel per day. The company pays $1100 per ton of steel purchased, and each order incurs a fixed cost of $2250. The holding cost is $275 per ton of steel per year. Using the EOQ model, calculate the optimal order quantity, cycle length, and average cost per year. Suppose that the steel supplier offers the auto manufacturer a price of $1490 per ton of steel if $\mathrm{Q} < 1200$ tons; $1220 per ton if $1200 \leq \mathrm{Q} < 2400$, and $1100 per ton if $\mathrm{Q} \geq 2400$. The annual holding cost rate, i, is 0.25.

1. (10%) Calculate Q^* and $\mathrm{g}(Q^*)$ for the all-units discount structure.
2. (10%) Calculate Q^* and $\mathrm{g}(Q^*)$ for the incremental discount structure.
3. (bonus, 5%) Write a Julia program to address (1.)
4. (bonus, 5%) Write a Julia program to address (2.)

Q2. (20%)

In the EOQ model with incremental quality discounts, prove that $Q_{j-1}^* < Q_j^*$ for all $\mathrm{j} = 1, \ldots, \mathrm{n}$.

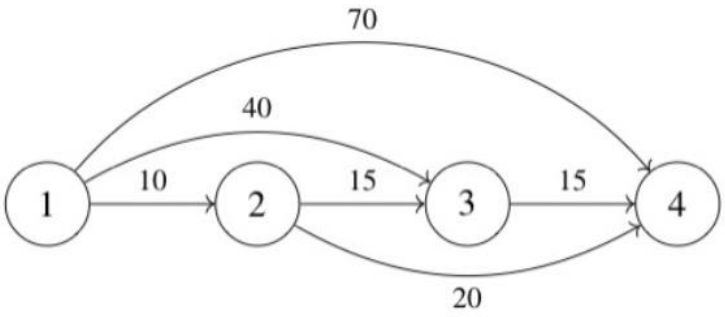
Q3. (20%)

For the snack bar in the last problem (where the replenishment orders are placed to a central warehouse located within the theme park, with negligible lead time, and it costs $10 in labor costs to deliver an order to the snack bar from the warehouse. And, it costs $1.2 per case per day in refrigeration costs and other holding costs to hold cases of food in inventory at the snack bar.), suppose now that the demand is different on different days of the week, as given in the following table. Replenishment orders can only be placed at the start of each day. The fixed and holding costs are as given in the last problem.

Day (#)	Day (Name)	Demand
1	Sunday	220
2	Monday	155
3	Tuesday	105
4	Wednesday	90

5	Thursday	170
6	Friday	210
7	Saturday	290

1. (10%) Assume that the snack bar uses a 7-day planning horizon, beginning on Sunday. Let c_{ts} be the cost to place an order on day t that will last through the end of day $s-1$, including both the fixed ordering cost and the holding cost. Calculate c_{12}, c_{47}, and c_{68}.
2. (10%) Suppose instead that the snack bar uses a 3-day planning horizon and that the shortest path network representing fixed and holding costs is as given in figure below (The numbers in this figure come from different data than those in 1.) On which day(s) should the snack bar place orders?
3. (bonus, 5%) Write a Julia program to address 1.
4. (bonus, 5%) Write a Julia program to address 2.



Q4. (40%)

Does the Wagner-Whitin model approach the EOQ model as the length of a time period gets shorter (keeping the total time horizon fixed)? Conduct a small numerical experiment using Julia or Spreadsheet (e.g. Excel) to confirm your answer.