ECE666
Project-2: ELD and Compromise Programming

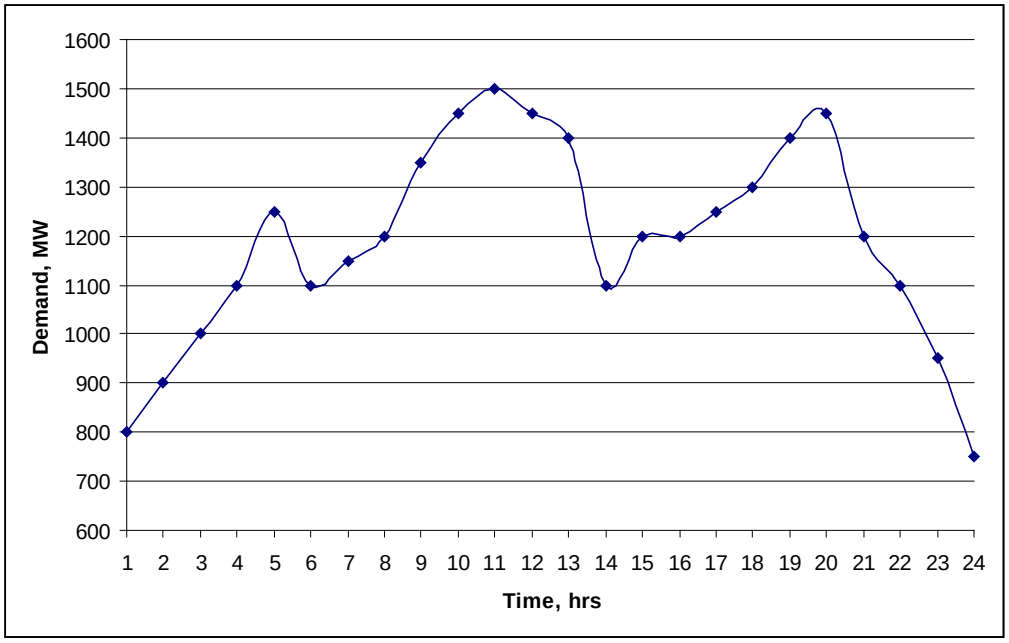
An electric utility has four generators whose cost characteristics and capacity limits are given in the table below. It is desired to find the optimum operating point for these generators.

Unit	P_{Max}, MW	P_{Min}, MW	Cost Coefficients		
			a_i	b_i	C_i
1	600	150	0.003	2.45	105.0
2	500	100	0.005	3.51	44.4
3	300	50	0.006	3.89	40.6
4	300	50	0.004	2.78	66.9

The standard form of generator cost function is given as follows:

$$C_i = a_i P_i^2 + b_i P_i + c_i$$

The 24-hour system demand profile is as follows:



Required Tasks:

1. Develop the Economic Load Dispatch (ELD) program and obtain the ELD schedule for the generators.

2. Plot the hour-wise generation dispatch from each unit, the total system cost and the system marginal cost. Report if there are any other non-zero Lagrange multipliers at any hour.

3. Now, let the transmission loss function be given by:

$$P_{Loss} = 0.00003P_1^2 + 0.00009P_2^2 + 0.00012P_3^2 + 0.00007P_4^2$$

   Find the new ELD solution considering losses. Plot the new set of results as in (2) and discuss the differences.

4. Find the **Minimum Loss Dispatch**. Plot results as in (2) and explain the differences in generation schedules. Explain the significance of Lagrange multipliers.

5. **Compromise Programming**
   It is practically impossible to achieve a solution which results in minimum cost and minimum loss simultaneously. The best way to get around this problem is to define a *compromise objective function*, which is similar to a distance function from the origin (0,0) to the cost-loss curve (on a 2-dimensional cost-loss coordinate system). Define a compromise objective function as given below and find the compromise dispatch solution.

$$Compromise = \sqrt{\left(\frac{Cost}{Cost_{\min}}\right)^2 + \left(\frac{Loss}{Loss_{\min}}\right)^2}$$

6. Provide graphs for hour-wise generation dispatch from each unit, and the total system cost. Determine the system marginal cost for each hour and plot. Compare these results with (2) and (3).