MOCK MIDTERM EXAMINATION

Answer to Question 4:

Part II: Numeric Problem. (Total points: 25). Be sure to show all of your work.

Question:
4. The peak and off-peak periods of electricity demand are of equal length. Demand in the peak period is $P^P=100-Q^P$ and in the off-peak period $P^0=A-Q^0$. Production is fixed proportions with variable costs of \$2 per unit and capital costs per period of β. Capacity costs are sunk and capacity cannot be adjusted between periods.
(a) Suppose that A=50 and β=4. Find the optimal capacity, peak price, and off-peak price.
(b) Suppose that A=90 and β=8. Find the optimal capacity, peak price, and off-peak price.

Answer:
4.
(a) In order to find the optimal capacity, we first add the demand curves vertically (as we would do in a public good problem where we are interested in finding out the total willingness to pay), and then optimal capacity k* will be determined by the long run marginal cost curve (LRMC), which will include both marginal costs (b) and unit capacity costs (β). Total marginal willingness to pay is P=150-2Q for $Q \in [0,50]$ and P=100-Q for $Q \in [50,100]$.
Since LRMC are low compared to demands, we find optimal capacity by calculating the quantity demanded by peak consumers when the price equals this LRMC, that is, $k^*=Q^P(b+\beta)$ or k*=94. As a result, off-peak consumers pay the efficient price P^0=MC=2, peak consumers pay P^P=LRMC=6.
(b) If A=90, b=8. $k^*=Q^P(b+\beta)$ or k*=90. As a result, off-peak consumers pay the efficient price P^0=MC=2 and peak consumers pay P^P=LRMC=8+2=10.