TSIN02 Internetworking

Exercise class 4 solutions

Exercise 1:
a) 25 SEK.
b) -200 SEK.
c) Under flat rate, the customers are unhappy since the net utility is negative. On the other hand, with usage-based pricing, the users are happy since the net utility is positive. This follows from that the underlying utility function is based on a user poll where the users tell how much they are willing to pay for different amounts of data.

Exercise 2: The net user utility before service upgrade is 200 SEK, and after service upgrade is -800 SEK. The service upgrade should thus not be done while applying this new pricing scheme.

Exercise 3:
a) See Fig. 1.
b) See Fig.2.
c) Both groups of customers have positive net utility for usage-based pricing.

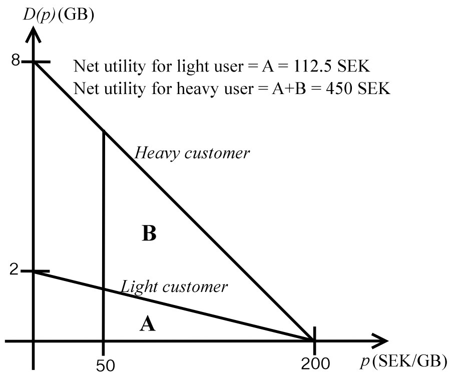

Figure 1: Demand $D(p)$ as a function of price p in solution 3.a.

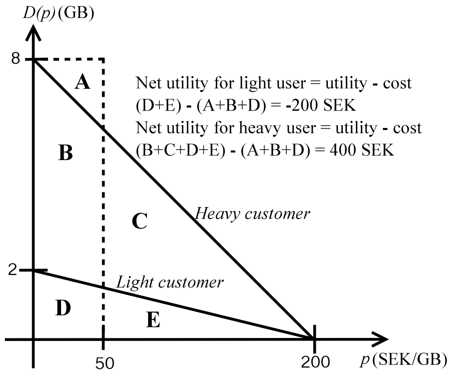

Figure 2: Demand $D(p)$ as a function of price p in solution 3.b.

Exercise 4:
a) 500 SEK.
b) -150 SEK.
Exercise 5: The cost of exceeding capacity at day is

$$c_{day} = \max[100(d_{A,day}(1 - q_A(p)) + d_{B,day}(1 - q_B(p)) - 12), 0].$$

The cost of exceeding capacity at night is

$$c_{night} = \max[100(d_{A,night} + d_{A,day}q_A(p) + d_{B,night} + d_{B,day}q_B(p) - 12), 0].$$

The rewards given out is

$$c_{reward} = p(d_{A,day}q_A(p) + d_{B,day}q_B(p)).$$

Therefore the objective function is to minimize $c_{day} + c_{night} + c_{reward}$ with the constraint $p \in [0, 100]$.
The optimal p can be found by a numerical search over p from 0 to 100, and find the one with lowest objective function value.