# ECON/ENVR/SOSC 2310 Assignment 3
# (Suggested Solution)

**Note:**

1. In question 1c, an explanation on why social optimum is better than competitive equilibrium is necessary, or you will lose at least 2 point.
2. Also in question 1c, some of you have the results for social optimal level, but do not write the solving process here.

1. Guards patrolling the mall provide a service without rivalry: all the stores in the mall are simultaneously protected. The demand for the electronics store, which suffer a big loss if thieves strike, is $Q_1 = 9 - 0.5P$, where $Q_1$ is demand of guards per hour, and P is the price of guard service. The ice-cream parlor, which loses less from a theft, demands fewer guards at any given price. Its demand is $Q_2 = 7 - P$. (21')
   A competitive market supplies as many guards as the stores want at $10.
   (a) If stores act independently, what is the competitive market equilibrium? How many guards each store will hire? Show the results mathematically and graphically. (7')

   For store 1, 18-2Q1=10
   Q1=4
   Graph: D1
   For store 2, 7-Q2=10
   Q2= -3 (firm 2 won't hire any guard.)
   Graph: D2

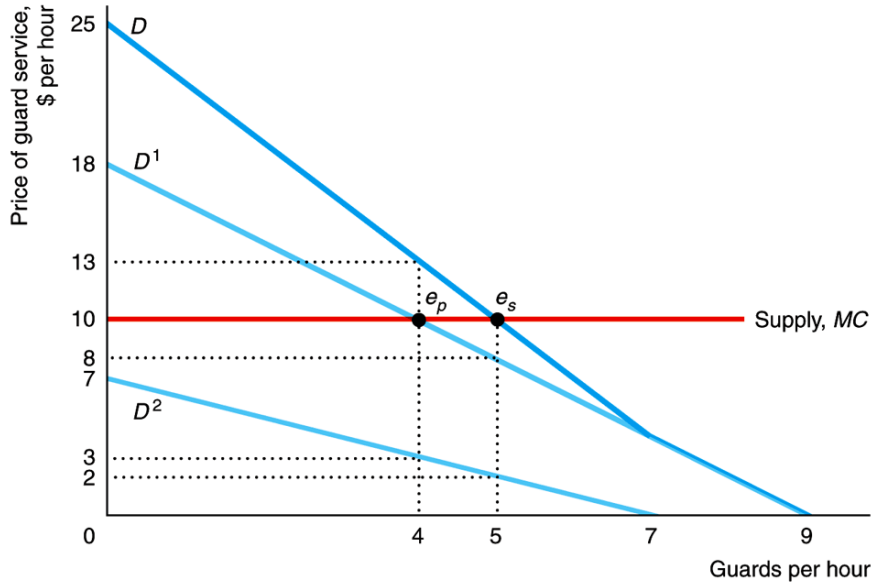
   (b) What is the marginal benefit to society of guard service, given that a guard patrolling the mall protects both stores at once? Show and discuss your results with a graph. (7')

   Summing store 1's and store 2's demand curve up vertically, we get
   P=25-3Q if Q<=7 and P=18-2Q if Q>7
   Thus MB = 25-3Q if Q<=7 and MB = 18-2Q if Q>7, and given a guard patrolling the mall protects both stores at once, the marginal benefits will be 22.
   Graph: D3

   (c) Is the competitive market equilibrium optimal to the society? If yes, explain why. If no, find the optimal level of guard service and explain why. (7')

   No. The optimal level is 5 (3') (by solving 25-3Q=10) (2').

   The ice-cream store can get guard services without paying because the guard service is a public good, and here the ice-cream store acts as a **free rider**. Acting alone, the television store hires fewer guards than are socially optimal because **it ignores the positive externality provided to the ice-cream store**, which the television store does not capture. Thus, the competitive market for guard services provides too little of this public good. (2')




2. The Pristine River has two polluting firms on its banks. Acme Industrial and Creative Chemicals each dump 100 tons of glop into the river each year. The cost of reducing glop emissions per ton equals $10 for Acme and $100 for Creative. The local government wants to reduce overall pollution from 200 tons to 50 tons. (20')

(a) If the government knew the cost of reduction for each firm, what reductions would it impose to reach its overall goal? What would be the cost to each firm and the total cost to the firms together?(7')

Since the cost of reducing the emission of Acme Industrial is less than the cost for Creative Chemicals, the government would impose a reduction of 100 tons for Acme Industrial and a reduction of 50 tons for Creative Chemicals.

Cost:

Acme Industrial: $10*100tons= $1000

Creative Chemicals: $100*50tons=$5000

Total: $1000+$5000=$6000

(b) In a more typical situation, the government would not know the cost of pollution reduction at each firm. If the government decided to reach its overall goal by imposing uniform reductions on the firms, calculate the reduction made by each firm, the cost to each firm, and the total cost to the firms together. (7')

Cost:

Acme Industrial: $10*75tons= $750

Creative Chemicals: $100*75tons=$7500

Total: $750+$7500=$8250

(c) Compare the total cost of pollution reduction in parts (a) and (b). If the government does not know the cost of reduction for each firm, is there still some way for it to reduce pollution to 50 tons at the total cost you calculated in part (a)? Explain. (6')

Yes. Government can allocate the same emission permit to each firm, and firms can sell or buy the permit in the market. (Cap and trade)

3. Two companies require identical skills and training from their workers. Both employ 10,000 people. On average, Safety First has one worker fatality per year, while Safety Second has two worker fatalities per year. Jobs at Safety First pay $50,000/year, while jobs at Safety Second pay $50,500/year. (24')
(a) Why do these jobs with identical requirements pay different salaries, based on the information presented here? (5')

If the salaries were the same, people would prefer to work at Safety First, since it is safer. The higher salary at Safety Second provides an incentive for people to accept its higher risk.

(b) What is the risk for a worker of a fatal accident at each company? What is the pay premium associated with the higher risk? (5')

The risk at Safety First is 1/10,000, or $10^{-4}$; at Safety Second, it's 2/10,000, or $2*10^{-4}$. The pay premium associated with the higher risk is the increase in pay of $500/year.

(c) The value of a statistical life is the difference in wage divided by the difference in risk. What is the value of a statistical life for workers with these skills and training? (7')

VSL : $(50{,}500 - 50{,}000)/(2 * 10^{-4} - 1 * 10^{-4}) = 500/10^{-4} = 5*10^{6}$

(d) Do you expect this value of a statistical life to be appropriate for the population as a whole? Why or why not? (7')

If the value of a statistical life is constant across all populations, this value is fine. If there are differences—for instance, by age or health status—then this value only applies to working people, not the very young, very old, or those who are not able to work.

3.

4. Estimate the value of the "Harbor View" (Victoria Harbor) for HK's hotels each year. State clearly how you sample the hotels, what assumptions you make, what data you collect, what method(s) you use, and what is your rough estimate of the value of the "harbor view".
(Note: you cannot possibly collect data for all hotels, so you need to make assumptions when necessary) (35')

(1) Assumptions – (1~4):
    a. Make correct assumptions. (4')
(2) Data – (2~20):
    a. Collect and show your data across different days/seasons/months/years (12')
        i. If only one time point (5')
        ii. - Or if only one hotel (5')
        iii. Huge samples may get higher points here because of your efforts on collecting the data.
    b. Show that your samples are reliable to estimate the harbor view (your selection criterion) (8')
        i. The rooms are within one hotel and very similar according to their size, beds… (This is the reason why your samples are comparable.)
        ii. The hotels are at the same district, same level (5 stars, 4 star) if you want to estimate the value across hotels.
(3) Calculations – (1~8)
    a. If your selection criterion is correct, then your calculation can get points:

i. Estimate the average differences, across time/district or within one hotel.. However, your interpretation on the number should be correct. (8)
ii. Draw a graph to show the difference.
iii. Regression is no need here. If you do it, you can also get points if your interpretation is correct, but you will not get any bonus.
iv. Find a way to estimate the harbor view value for all hotels.
v. There is no judgement on your calculation results, unless your calculation results are absurdly wrong.

(4) Overall: for good answer in overall (0~5).
   a. Your total points in this question will not be higher than 35.

A suggested solution here:

(1) As I cannot get the data across all the hotels and all the time, I first assume that my sample hotels and selected time can represent all the hotels across time.
(2) Data: Get the data from www.expedia.com.hk based on the following rules:
   a. The rooms are selected from 4+ star hotels with assumption that most of the hotels with harbor view are upscale.
   b. The hotels are selected from two districts, Central and Tsim Sha Tsui with assumption that the most valuable harbor view are related to these to districts.
   c. The rooms are selected based the characterizes on 'free cancellation', similar sizes, harbor view options, beds number, guests number and whether they are club rooms. The selected variables and details can be found in figure 1 and attached dataset.

**Sky Harbour Room**
37 square metres
1 King Bed
(Extra beds available: Crib)
Room sleeps 2 guests
(up to 1 child)
More details

| | | |
|---|---|---|
| Non-Refundable<br>Free Internet<br>Breakfast Available - HK$275.00<br>No Expedia booking fees | We have 1 room left<br>**HK$2,730**<br>~~HK$3,900~~<br>Sale! | Reserve<br>It only takes 2 minutes |
| Non-Refundable<br>Breakfast Included<br>Free Internet<br>No Expedia booking fees | We have 1 room left<br>**HK$2,925**<br>~~HK$3,900~~<br>Sale! | Reserve<br>It only takes 2 minutes |
| Free Cancellation<br>until Sunday, 13 May<br>Reserve now, pay later<br>Free Internet<br>Breakfast Available - HK$275.00<br>No Expedia booking fees | We have 1 room left<br>**HK$3,900** | Reserve<br>It only takes 2 minutes |

**Sky Deluxe Room**
Room with view
40 square metres
1 King Bed
(Extra beds available: Crib)
Room sleeps 2 guests
(up to 1 child)
More details

| | | |
|---|---|---|
| Non-Refundable<br>Free Internet<br>Breakfast Available - HK$275.00<br>No Expedia booking fees | We have 2 rooms left<br>**HK$2,450**<br>~~HK$3,500~~<br>Sale! | Reserve<br>It only takes 2 minutes |
| Non-Refundable<br>Breakfast Included<br>Free Internet<br>No Expedia booking fees | We have 2 rooms left<br>**HK$2,625**<br>~~HK$3,500~~<br>Sale! | Reserve<br>It only takes 2 minutes |
| Free Cancellation<br>until Sunday, 13 May<br>Reserve now, pay later<br>Free Internet<br>Breakfast Available - HK$275.00<br>No Expedia booking fees | We have 2 rooms left<br>**HK$3,500** | Reserve<br>It only takes 2 minutes |

Figure 1. An example for Selected Hotels. The room characteristics and price will be recorded to dataset.

d. If we can find two rooms within one hotel with very similar characteristics, and one has habor view and the other has no view. The only price differences of these two hotels in the same day is reliable to be caused by the harbor view differences, which indicates add-value from the harbor view. By calculating the price differences and comparing the price across hotels and across time, we can find the average add-values from the harbor view across hotels and across time.

(3) The selected data is summarized in Table 1. If the room size, beds number are quite similar, then the price differences are calculated to find the add-value from the harbor view. (I have uploaded the whole data set as an excel, it contains more data and you can use it do the analysis in details.)

(4) The variables view refers to the harbor view of this room, = 1 if with a harbor view, = 0 if no harbor view. And 'size' indicates the room size ($m^2$). And 'beds' and 'consumers' indicate the capacity of beds and guests respectively. The sample price was collected from the date 15/02/2018, 15/05/2018, 15/08/2018 and 15/11/2017. The 'club' is a variable indicating whether this room is a club-level room. The variables 'd_Feb'~'d_Nov' calculate the price differences between two similar rooms with and without harbor view.

(5) By aggregating the price differences, you can get the add-value of the harbor view across hotels and time.

Table 1. Selected Data

| Level | Name | Location | View | Size | Bed | Consumer | Feb | May | Aug | Nov | club | d_Feb | d_May | d_Aug | d_Nov |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | The Peninsula Hong Kong | Tsim Sha Tsui | 0 | 43 | 1 | 3 | 4480 | 4280 | 4880 | 5480 | 0 | | | | |
| 5 | The Peninsula Hong Kong | Tsim Sha Tsui | 1 | 44 | 1 | 3 | 6380 | 5980 | 5980 | 7380 | 0 | 1900 | 1700 | 1100 | 1900 |
| 5 | The Peninsula Hong Kong | Tsim Sha Tsui | 0 | 88 | 1 | 3 | 6680 | 6680 | 6680 | 7680 | 0 | | | | |
| 5 | The Peninsula Hong Kong | Tsim Sha Tsui | 1 | 84 | 1 | 3 | 10680 | 10680 | 10680 | 11680 | 0 | 4000 | 4000 | 4000 | 4000 |
| 5 | The Peninsula Hong Kong | Tsim Sha Tsui | 0 | 125 | 1 | 3 | 8080 | 7980 | 8080 | 9080 | 0 | | | | |
| 5 | The Royal Garden | Tsim Sha Tsui | 1 | 42 | 1 | 2 | 3500 | 3700 | 3800 | 5100 | 0 | 200 | 200 | 200 | 300 |
| 5 | The Royal Garden | Tsim Sha Tsui | 0 | 40 | 1 | 2 | 3300 | 3500 | 3600 | 4800 | 0 | | | | |
| 5 | Kowloon Shangri-La | Tsim Sha Tsui | 1 | 45 | 2 | 2 | 2800 | 2800 | 3000 | 5900 | 0 | 600 | 600 | 600 | 1700 |
| 5 | Kowloon Shangri-La | Tsim Sha Tsui | 0 | 42 | 1 | 2 | 2200 | 2200 | 2400 | 4200 | 0 | | | | |
| 5 | Kowloon Shangri-La | Tsim Sha Tsui | 1 | 88 | 1 | 2 | 4880 | 4880 | 5080 | 6980 | 0 | 900 | 900 | 900 | 900 |
| 5 | Kowloon Shangri-La | Tsim Sha Tsui | 0 | 82 | 1 | 2 | 3980 | 3980 | 4180 | 6080 | 0 | | | | |
| 5 | Sheraton Hong Kong Hotel & Towers | Tsim Sha Tsui | 1 | 30 | 1 | 2 | 2000 | 2100 | 2500 | 4000 | 0 | 300 | 300 | 300 | 300 |
| 5 | Sheraton Hong Kong Hotel & Towers | Tsim Sha Tsui | 0 | 27 | 1 | 2 | 1700 | 1800 | 2200 | 3700 | 0 | | | | |
| 5 | Sheraton Hong Kong Hotel & Towers | Tsim Sha Tsui | 0 | 27 | 2 | 2 | 1700 | 1800 | 2200 | 3700 | 0 | | | | |
| 5 | Sheraton Hong Kong Hotel & Towers | Tsim Sha Tsui | 1 | 35 | 1 | 3 | 2100 | 2200 | 2600 | 4100 | 0 | 400 | 400 | 400 | 400 |