2.2 Price Discrimination

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2.2 Price Discrimination

Everyday situations where price discrimination occurs:

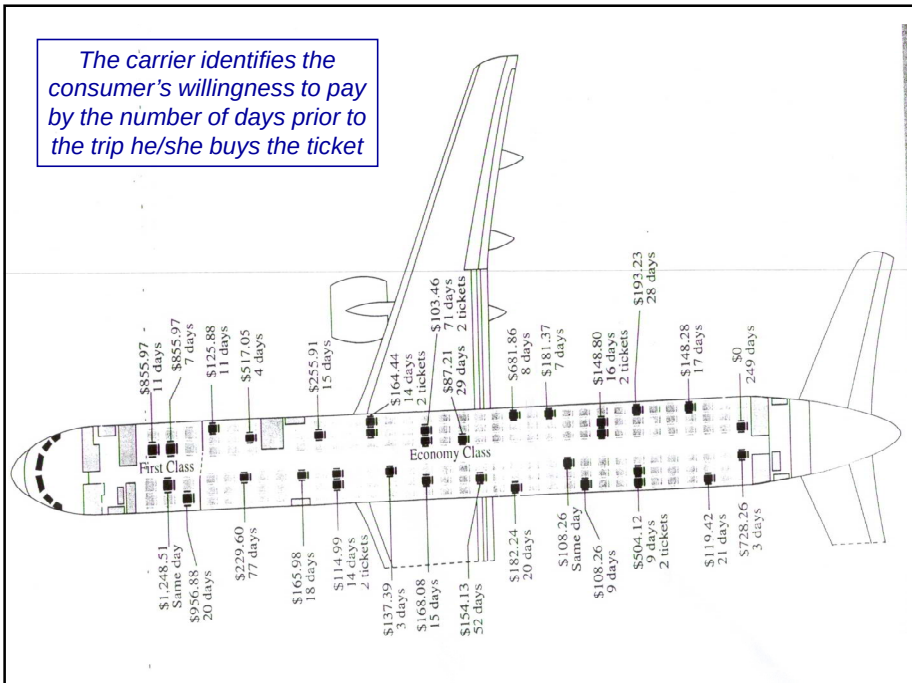
- Quantity Discounts – **The same good is sold at different per unit prices to the same consumer** depending on the quantity he/she buys. Ex: 2 for 1.
- When telephone companies charge a fixed tariff independently of the number of calls. It is a quantity discount since those that make more calls pay less per call.
- Doctor in a small village
- Doctor that charges different fees to insured and uninsured patients – **the same service is sold to different consumers at different prices.**
- Geographical Discrimination– "The Economist" Netherlands 1.69 Euros, Spain 1.46 Euros

2.2 Price Discrimination

More examples …

- Student Discounts
- Tariffs varying with the time of the day (telephone, electricity, etc)
- “Speedy boarding” at EASYJET
- Price of meals at restaurants (lunch is *much* cheaper than dinner).
- Frequent flyer programs
- Also, similar programs at the Laundry, the hairdresser, etc. offer loyalty cards where they mark the number of services consumed. After X services, we get 1 for free.
- Coupons – allow charging a lower price to those that have more time or more elastic demands.

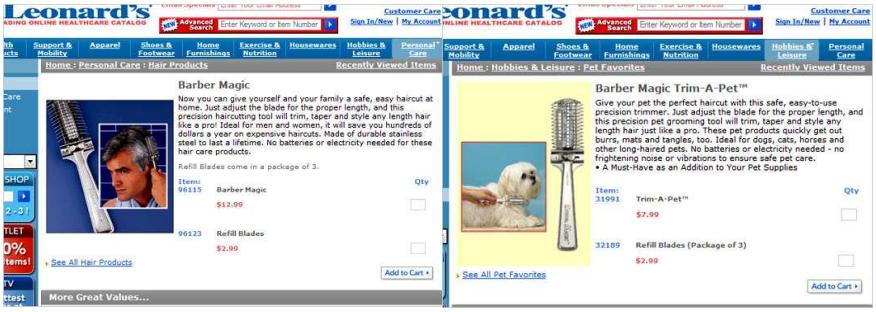
The carrier identifies the consumer’s willingness to pay by the number of days prior to the trip he/she buys the ticket



2.2 Price Discrimination

… a true example from The NY times blog:

http://freakonomics.blogs.nytimes.com/2008/05/08/to-discriminate-you-need-to-separate/



"Other than the names on the packages and a bit of different description, the products are identical; and even the styles of the packages are identical. Putting advertisements for both packages in the same catalog is a poor way of creating market separation: If I had hair and needed to cut it, I would simply buy the Trim-a-Pet for my personal use and save the $5. This is a bad attempt at market separation."

2.2 Price Discrimination

… another example from The NY times blog:

http://www.freakonomics.com/2011/02/14/a-gullible-american/

The Caffé Nero outlet in London I visited recently has different prices for take-out and in-store cups of coffee — £1.65 for take-out, £1.75 for in-store.

Given the costs of space for tables to sit at, and the need to own and wash cups and saucers, the price difference must be way too small to make this cost-based price discrimination. But it can't be demand-based price discrimination either — I don't see why the demand elasticity should be lower for in-store than for take-out. My guess is that it is cost-based in part, but that the difficulty in separating the two markets leads to the small price difference. The woman sitting at the next table is drinking coffee out of a take-away cup, having clearly paid the lower price, but enjoying the in-store ambience (and free Wifi). I think it just doesn't pay for the baristas to police table usage, so that knowledgeable customers pay the lower price — whereas a gullible American like me pays the higher price!

2.2 Price Discrimination

- Another example from the Economist –

"how deep are your pockets?"

2.2 Price Discrimination

- Def: In general we say that a seller price discriminates if 2 units of the same good are sold at different prices (either to the same or to different consumers). This definition, however, is incomplete:
  - Differences in prices at different locations may simply reflect differences in costs.

2.2 Price Discrimination

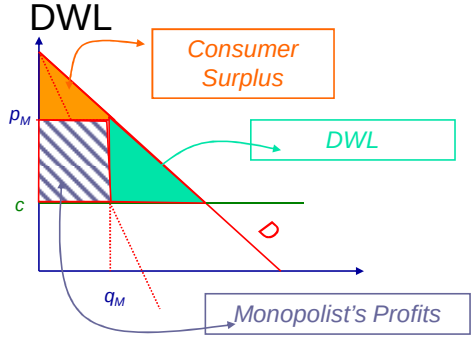
- And what if the good/service is not exactly the same, does that mean we cannot talk about price discrimination?

Sometimes there is price-discrimination although the good is not exactly the same (case in which the quality of the good/service is different e.g. Business versus Economy class in airplanes.) We say that there is price discrimination if the differences in prices do not correspond to the differences in costs.
In the airplane example there is price-discrimination:

1) across classes (Business and Economy) where service is different but does not seem to be large differences in costs and also 2) within class where the service is the same, the only difference is the time at which consumers purchase their ticket.

2.2 Price Discrimination

Why do firms engage in price discrimination? So far we have only seen the case where the monopolist sets a uniform price. This led to a situation where the consumer surplus was positive and there was a DWL



Price Discrimination allows the monopolist to appropriate part (or the whole) of the consumer surplus and the DWL

2.2 Price Discrimination

Firms may only price discriminate if arbitrage is not possible. There are two types of arbitrage:

- Linked to the transferability of the commodity or Product Arbitrage – if transaction costs between 2 consumers are low then it will be difficult to charge different prices to different consumers. The consumer that buys the commodity at a cheaper price would have an incentive to buy large amounts and resell it at a profit to the other consumers. **In such cases price discrimination is not possible**. In the case of a doctor, for example, the transaction costs are extremely high and therefore price discrimination is possible.

2.2 Price Discrimination

Reasons that may prevent product arbitrage:

1. Services – The majority of services are not transferable across consumers
2. Product Warranties – The producer may limit the warranty of the product to the original purchaser. For example, in the case of cars, the warranty is attached to the original purchaser and owner. If the car is later sold to someone else the warranty is lost, the second owner will not enjoy the warranty.
3. Product specificity – The producer may change the product to avoid other uses. For example what would be desirable to do in the CD and DVD industry to avoid the reproduction of videos and music.
4. Transaction Costs – If the transaction costs are high enough this avoids the product resale and allows price discrimination. Two examples are: tariffs to imported goods and transportation costs both of which may allow different prices in different countries.

2.2 Price Discrimination

Reasons that may prevent product arbitrage (cont):

5. Contractual clauses – forbid the resale of the product.
6. Vertical Integration – A firm may sell the same good for two different uses. For example the sale of aluminium to produce cable or for plane parts. The firm would like to charge the airplane company a higher price for the aluminium but it must avoid the resale from the cable producers to the airplane company. The solution: to integrate the cable company and in this way avoid the resale.
7. Government Intervention – Until January 1, 2003, electricity consumers had distinct access to the market and therefore they had different tariffs depending on their consumption.

2.2 Price Discrimination

- Arbitrage linked to the Transferability of the demand or Demand Arbitrage – In this case there is no transfer of the good among consumers. It is the consumer who may alter his demand decisions. Ex-ante, the producer does not know which type of consumer you are (say Student or non-Student or Business and Economy class type). Suppose the producer offers two different prices, a lower one for students and a higher one for non-students. If it wasn't possible to show a student card than everyone would claim to be a student in order to enjoy the discount. In these situations the producer would offer a lower price but also a somewhat lower quality (e.g. back sits in the theatre) such that the non-students are discouraged to buy the cheapest sits.

2.2 Price Discrimination

There are 3 types of price discrimination:

- **First-Degree** price discrimination or Perfect Price Discrimination. The monopolist manages to extract all consumer surplus.
- **Second-Degree** price discrimination – The monopolist has incomplete information, he knows that there are different types of consumers and knows their tastes but cannot tell them apart ex-ante, i.e. before purchase. He must use self-selection devices to set the right price-quantity or price-quality packages.
- **Third-Degree** – The monopolist can separate the markets, he uses some signal (e.g. age, profession, location) in order to set different prices.

2.2 Price Discrimination – 1st degree

First-Degree Price Discrimination –

1st case: the doctor in a small village

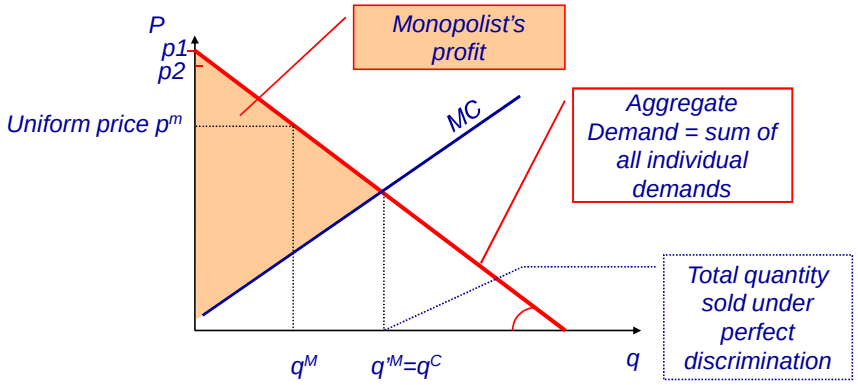
The monopolist sets different prices for each consumer and for each unit they buy.

- Information: The monopolist is able to identify each consumer
- Arbitrage: not possible
- Prices: will be different to each consumer and each unit

2.2 Price Discrimination – 1st degree

- Unit demand {0,1}
- v_i is consumer i willingness to pay for 1 unit of the good
- Hence $p_i = v_i$
  - Each consumer pays a different price
  - The price each consumer pays is their maximum willingness to pay for the good. The consumer is left without surplus, the monopolist is able to extract all the surplus.
  - Perfect discrimination leads to an efficient level of output in the market (the same as in perfect competition)

2.2 Price Discrimination – 1st degree



Note: there are no efficiency losses (no DWL)! The total quantity sold is the same as under perfect competition

2.2 Price Discrimination – 1st degree

2nd case: N identical consumers

- Suppose there are n identical consumers with individual demand D(p)/n. In this case the monopolist may also extract all the consumer surplus using what is called two-part tariff.

$$T(q)=A+pq$$

$T(q)$: total paid for q units

where A is fixed and paid independently of the quantity consumed and p is the variable part.

2.2 Price Discrimination – 1st degree

Two-part tariffs:

$$T(q)=A+pq$$

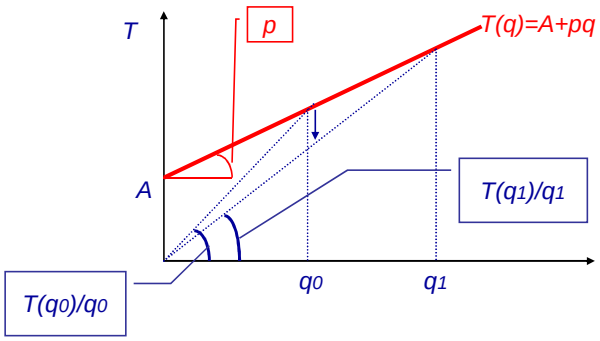
Access fee (A) *Unit fee* (p)

When A>0, T(q) corresponds to a quantity discount

Examples:

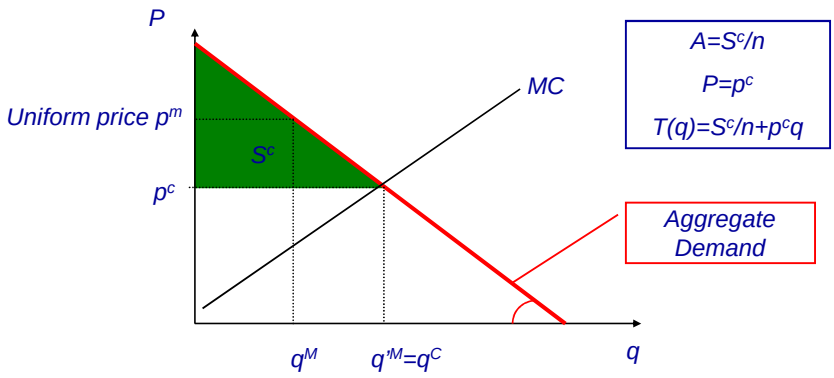
Electricity, water ,etc	A=monthly fee p=Kwatt
Polaroid photos	A=camera p=film
Amusement park	A=entry fee p=each attraction
Taxi	A=fixed fee p=km
Razor blades	A=handle p=price of blade
Disco	A= entry p=drink

2.2 Price Discrimination – 1st degree



The average price when consumer buys q_1 is lower than when he buys q_0: $T(q_1)/q_1 < T(q_0)/q_0$

2.2 Price Discrimination – 1st degree



Note: There are no efficiency losses, no DWL! The total quantity sold is again the same as in perfect competition. $p=p^c$ maximizes the consumer surplus in order to be extract by the monopolist through the payment of A.

2.2 Price Discrimination – 1st degree

How do we compute the net consumer surplus in order to set A?

$$S^c = \int_0^{q^c} [p(q) - p^c]dq$$

The Monopolist's profit is given by:

$$nA + p^c q^c - C(q^c) = n\frac{S^c}{n} + [p^c q^c - C(q^c)] = S^c + [p^c q^c - C(q^c)] =$$

Total Welfare in perfect competition $> \Pi^M$ (uniform pricing)

2.2 Price Discrimination – 1st degree

3rd case: individual tariffs- continuous demands

- Consumers are not identical
- The monopolist knows each consumer's individual demand (not unit demand) and sets two-part tariffs specific to each consumer:

$$T_i(q) = A_i + p^c q$$

where p^c=MC and $A_i = S_i^c$(consumer i's surplus when $p=p^c$)

- The net consumer surplus is equal to zero as well in this case.

2.2 Price Discrimination – 1st degree

Why don't we see more real life examples of 1st degree price discrimination?

- The information needed is too demanding and costly
- The possibility of arbitrage in many markets hinders the chances of perfect discrimination even further.

2.2 Price Discrimination – 3rd degree

3rd degree price discrimination: "Multi-market"

- Information: Monopolist may distinguish between groups of consumers
- Product Arbitrage: Only possible within each consumer group not across groups e.g. a middle-age person cannot own a discount card aimed for the elderly.
- Prices: May be different across consumer groups but must be the same within each group. That is, within each market, the monopolist cannot price-discriminate.

2.2 Price Discrimination – 3rd degree

- This is the most typical form of price-discrimination
- The seller is able to distinguish across different types of consumers ex-ante and therefore is able to charge them different prices.
- The monopolist can distinguish consumer groups through a signal (location, age, gender, etc.)
- There is no arbitrage across groups
- Examples: student discounts, senior discounts, different prices according to the location

2.2 Price Discrimination – 3rd degree

- The monopolist produces a single good
- m different markets
- Linear (uniform) prices in each market $\{p_1, p_2, \ldots p_m\}$.
- $\{q_1=D_1(p_1), \ldots\ldots q_m=D_m(p_m)\}$ the demands in each market are independent i.e. they only depend on the price charged in that market not on other markets' prices.

2.2 Price Discrimination – 3rd degree

We may write the monopolist's problem as:

$$\underset{\{p_1,p_2,\ldots p_m\}}{Max} \sum_{i=1}^{m} p_i D_i(p_i) - C\underbrace{\left(\sum_{i=1}^{m} D_i(p_i)\right)}_{\text{Aggregate Demand = Total production}}$$

Note: the problem may be interpreted as a multi-product monopolist

FOC: $\frac{\partial \Pi}{\partial p_i} = 0$ for $i = 1,\ldots m$

$$\Leftrightarrow \quad D_i(p_i) + p_i D_i'(p_i) - C'\left(\sum_{i=1}^{m} D_i(p_i)\right) D_i'(p_i) = 0$$

$$\Leftrightarrow \quad [p_i - C'(Q)] = \frac{-D_i(p_i)}{D_i'(p_i)} \Leftrightarrow \boxed{\frac{p_i - C'(Q)}{p_i} = \frac{1}{\varepsilon_i(D_i(p_i))}}$$

2.2 Price Discrimination – 3rd degree

Alternatively the FOC may be written as:

$$\underbrace{p_i\left[1 - \frac{1}{\varepsilon_i(D_i(p_i))}\right]}_{\text{Marginal Revenue } i} = C'(Q)$$

This condition means that the monopolist decides on prices (or quantities) such that marginal revenues are identical across markets

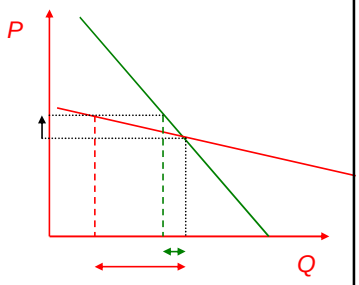
$$\text{MR}_1 = \text{MR}_2 = \ldots = \text{MR}_m = C'(Q)$$

which implies that if $\varepsilon_i > \varepsilon_j \Rightarrow p_i < p_j$

2.2 Price Discrimination – 3rd degree

Conclusion: The optimal pricing policy for the monopolist is to charge a lower price to the those consumers with the higher demand-elasticity. This explains the typical discounts applied to students, seniors, as well as 1st time magazine subscribers.

(Intuition: the monopolist may charge a higher price when demand elasticity is low because an increase in price leads to a lower reduction of demand.)



2.2 Price Discrimination – 3rd degree

Welfare consequences of the 3rd-degree price discrimination: what happens if the regulator forced the monopolist to set the same price in all its markets?

- The monopolist obviously obtains higher profits with 3rd degree price discrimination since uniform pricing is always a particular case.
- Consumers in the low-elasticity demand market will be worse off with 3rd-degree price discrimination since the price they face will typically be higher.
- Consumers in the high-elasticity demand market benefit from third-degree price discrimination because they will face a lower price.
- When the 3rd-degree price discrimination allows a new market (e.g. those markets where it would not be profitable for the monopolist to sell if forced to set the same price in all markets) then typically welfare increases.
- A necessary condition for welfare to increase under 3rd-degree price discrimination is that production should increase.

2.2 Price Discrimination – 2nd degree

2nd-degree price discrimination

- Information: The monopolist knows the tastes or types of consumers but cannot differentiate them ex-ante i.e. does not observe the willingness to pay of each consumer nor can he tell which type of consumer it is. The monopolist however must know the aggregate characteristics of the market (e.g. demand-elasticity of each type, size of the markets, etc).
- Product arbitrage: not possible.
- Consumers are heterogeneous
- Now if the monopolist wants to charge different prices he must either offer quantity discounts (price-quantity packages) or differentiate the product a bit (price-quality packages, e.g. business class, economy class, speedy boarding, etc.)
- Not possible to perfect discriminate but the monopolist may set self-selection mechanisms for consumers
- Prices: may be different across consumers. Prices will change according to the quantity (or quality) the consumer buys..

2.2 Price Discrimination – 2nd degree

Examples:

- Insurance: Insurance companies usually offer a menu of contracts whereby high-risk types select the complete coverage contract and low-risk types the partial cover (Rothschild & Stiglitz, 1976).
- Bundling – prices are not proportional
  - Fixed Menus at restaurants vs “a la carte”
  - Transport companies offer: one way tickets at more than half the price of roundtrip tickets.
  - Season tickets versus individual tickets
- http://economics.about.com/b/2008/01/02/real-life-price-discrimination-an-example.htm

2.2 Price Discrimination – 2nd degree

Example: In October 1996, One2One offers new plans. Among them are:

Plan:	Bronze	Gold
Monthly fee	£17,5	£36,0
Price per min	29p	18p

The firm wants those consumers that call more often to select the Gold plan and that those that call less select the bronze (instead of selecting another firm). Note in this example the firm uses two-part tariffs to engage in 3rd-degree price discrimination.

2.2 Price Discrimination – 2nd degree

Let's look at non-linear tariffs, the most general and interesting case.

When setting prices for the Business and Economy class sits for a particular route what restrictions should the monopolist observe?

(1) **Participation –** The air company wants to make sure that all consumer types are willing to buy at those prices. This sets an upper bound on the Economy class ticket. This bound is binding. The Economy-type consumer ("poorer") is left with no surplus**.**

(2) **Selection –** The air company wants to make sure that the business-type consumer i.e. the one with highest willingness to pay does not want to travel Economy. How to achieve this? limit the price differential between the Business and the Economy class. Given that the price in the Economy class is given by (1) this imposes an upper bound on the Business class ticket. That is if the price of the Business ticket is too high then the client prefers Economy.

2.2 Price Discrimination – 2nd degree

Model:

- 2 types of consumers, 1 and 2 in proportion λ and $1-\lambda$, respectively.
- Marginal Cost = c independent of the quality

Willingness to Pay \ Quality of the Product	High	Low
Consumer type 1	20	10
Consumer type 2	13	9

2.2 Price Discrimination – 2nd degree

- Suppose c=0 and λ=0,5 (share of high types)
- What prices and products may the monopolist offer? 2 strategies:
  1. Offer a single product.

     If we compare profits, the best thing to do under a single product strategy is to offer the high quality product to both types i.e. at price 13 and make a profit of 13×N

2.2 Price Discrimination – 2nd degree

- Offer both products at different prices $\{(p_A,q_A), (p_B,q_B)\}$. Such that the following holds:
  - **Incentive compatibility**: Both types of consumers prefer to buy what has been thought for them then the other good. More precisely, consumers of type 1 prefer (p_A,q_A) and consumers of type 2 prefer (p_B,q_B)
  - **Individual rationality**: Both types prefer to buy than not to buy

2.2 Price Discrimination – 2nd degree

- Formally:
  - **Incentive compatibility**: The surplus of consumer type 1 when buying (p_A,q_A) has to be at least as large as when buying (p_B,q_B) and the reverse for consumer type 2:

$$\underbrace{20-p_A}_{\text{Surplus of consumer type 1 when buying High quality}} \geq \underbrace{10-p_B}_{\text{Surplus of consumer type 1 when buying Low quality}}$$

$$\underbrace{9-p_B}_{\text{Surplus of consumer type 2 when buying Low quality}} \geq \underbrace{13-p_A}_{\text{Surplus of consumer type 2 when buying High quality}}$$

2.2 Price Discrimination – 2nd degree

- Individual Rationality: Both consumers must have non-negative surplus.

$20-p_A \geq 0$

$9-p_B \geq 0$

2.2 Price Discrimination – 2nd degree

- Formally we have 4 restrictions :

$$\begin{cases} 20 - p_A \geq 10 - p_B \\ 9 - p_B \geq 13 - p_A \\ 20 - p_A \geq 0 \\ 9 - p_B \geq 0 \end{cases} \Leftrightarrow \begin{cases} p_A - p_B \leq 20 - 10 = 10 \\ p_A - p_B \geq 13 - 9 = 4 \\ p_A \leq 20 \\ p_B \leq 9 \end{cases}$$

A constraint needed to avoid type 1 to prefer low quality

A constraint needed to avoid type 2 to prefer high quality

- Let's put pB at its maximum value pB=9 (binding I.R. of type 2)
- Then in this example (I.C. of individual 1 is binding):

$$\begin{cases} p_A \leq 10 + p_B \\ p_A \geq 4 + p_B \\ p_A \leq 20 \\ p_B = 9 \end{cases} \Leftrightarrow \begin{cases} p_A \leq 10 + 9 = 19 \\ p_A \geq 4 + 9 = 13 \\ p_A \leq 20 \\ p_B = 9 \end{cases} \Rightarrow p_A = 19$$

2.2 Price Discrimination – 2nd degree

Note that if type 1 would value low quality as low as type 2 or less than I.C. of type 1 would not bind and the monopoly would extract all the surplus from type 1 consumer.

Intuitively what we want is that the low demand consumer does not stop buying and that the high demand consumer does not buy the package thought for the low-demand consumer. Hence in general these two conditions are binding:

$20-p_A = 10-p_B$ (consumer type 1 is indifferent between the 2 packages, the firm charges consumer 1 the highest price possible to meet the constraint)

$9-p_B = 0$ (consumer type 2 is indifferent between buying and not buying, the monopolist charges him the highest price possible, the consumer is left without surplus)

2.2 Price Discrimination – 2nd degree

- The equilibrium prices are:
  - $p_B = 9$
  - $p_A = 19$
  - The monopolist's profit is:
  - $\Pi=[0,5\times(19-0)+0,5\times(9-0)]=14N$ > than the profit of selling a single product or package Therefore the firm prefers to offer the two products at these equilibrium prices.

Note: The monopolist extracts all the surplus from consumer type 2 (the low-demand consumer) and leaves consumer 1 with positive surplus : 20-19=1>0

2.2 Price Discrimination – 2nd degree

- What would change if the willingness to pay were? (key here is that the high demand type values the low quality good less than the low-demand type)

	High	Low
Consumer type 1	20	10
Consumer type 2	13	11