Externalities

Game Rules

- **Work in pairs.**
- **Everyone who is sitting on the odd row represents Firm A.**
- **Those who are sitting on the even row represent Firm B.**

•Let's play a game. First of all, clear your desks except for a pencil and a rubber. Raise your hand if you don't have any, I will lend them to you.

•Everyone who is sitting on the odd roll represents Firm A. Those who are sitting on the even roll represent Firm B (refer to Diagram 1).

Game Rules for Firm A

- **Answer 20 math problems in 3 minutes.**
- **Get 1 bonus point for each math problem answered correctly.**
- **The following resources can help Firm A:**
  - **a) Question paper**
  - **b) 5 pieces of paper for calculation**
  - **c) 1 pencil**

•Now, I am going to give each pair of you a record sheet. (Sample of the record sheet can be seen in Diagram 2).

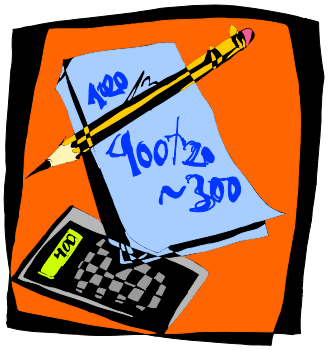
•The math problems should be a little bit complicated, so that some calculation on paper is needed. For example, 234x567.

Game Rules for Firm A

- **Write the answers on the space provided on the question paper.**
- **Calculation should be done ONLY on the 5 pieces of paper provided.**
- **No calculators and other scratch paper can be used.**
- **Don't write anything on the table.**
- **Cannot communicate with others, otherwise Firm A will loss the bonus points.**

•Please hand each Firm A a question paper and 5 pieces of paper.

Time to start!



•Let Firm A do the calculation for 3 minutes.

Time's up!

- **Firm B checks the answers and records Firm A's earnings on the records sheets.**
- **After recording the earnings, Firm A should give its 5 pieces of paper to Firm B.**

•After 3-minute calculation, project the answers on the screen.

Game Rules for Firm B

- **Produce paper airplanes by using the 5 pieces of paper.**
- **Receive 2 bonus points for each paper airplane produced in 3 minutes.**

•Show Firm B how to make the airplane.

•Distributes one A4 size paper to Firm Bs and ask them to follow the steps of folding the plane (use A4 papers for better demonstration result).

Games Rule for Firm B

❖ **The planes Firm B produces :**

1. **Must look exactly as same as the one produced by teacher.**

2. **Must be purely white.**

3. **If there is any pencil marks on the papers, Firm B will need to erase them.**

4. **Cannot tear off the part of paper that has pencil marks, otherwise, the plane produced will be in a smaller size.**

- Show to students a qualified plane and 3 disqualified planes

  i.e.one with some marks in the inner side of a paper airplane;

  one with no marks but dirt (like pencil marks not totally erased);

  one in smaller size due to the use of a smaller paper.

Time to start!

•Let Firm B make airplanes for 3 minutes.

Time's up!

- **Firm A counts the number of qualified airplanes made by Firm B.**
- **Firm A records the number on the record sheets.**

•After 3 minutes, time's up!

•Let Firm A count and record the number of airplanes made by Firm B.

What can the game show?

- **The game shows:**

  A common problem that exists in our Society

  - **Firm A represents an *upstream* firm which dumps waste into the river during production.**
  - **Firm B represents a *downstream* firm which has to use clean water in its production.**

What can the game show?

- **The game shows:**
  External Cost
  - **Firm B must pay to purify the water before it can be used.**
  - **Firm A imposes an *external cost* on Firm B.**

What can the game show?

- **The game show:**

  Negative externalities

  - **As long as Firm A need not consider the external costs imposed on Firm B, from social point of view, Firm A will continue to:**
    - **Over-utilize the clean water.**
    - **Over-produce its products.**
    - **Over-produce the negative externalities.**

  - **In economics, dumped waste is a kind of *negative externalities*.**

In Our Game

- **Who is producing negative externality?**
- **What is the externality?**
- **What is the external cost Firm B has to pay?**
- **When Firm A produces the answers of the problems, will Firm A consider the cost of Firm B?**

•Ans: Firm A

•Ans: pencil marks on those small papers

•Ans: the time used to erase pencil marks

•Ans: No, because Firm A doesn't know Firm B exists and even A knows, A won't care B's profit.

In Our Game

- **What can we do to make Firm A consider not only their own production costs, but also the cost it is imposed on Firm B?**
- **Should Firm A pay for using the papers? Should Firm B pay for the clean papers?**
- **If we think Firm A should pay, that means we assume who has the *property right* of blank papers? What if we think Firm B should pay?**

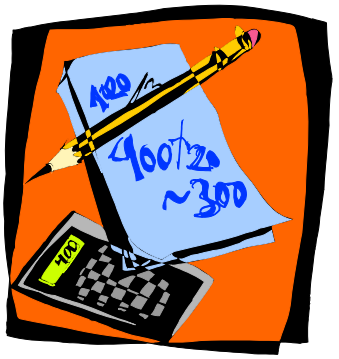
Play the game again

- **Each pair of Firm A and Firm B negotiate the payment scheme among themselves.**
- **Each pair has 5 minutes to decide who should pay for using the blank papers, and decide who owns the *property right* of the blank papers.**
- **The game is repeated with the payment scheme is incorporated. Firm A has another set of 20 math problems.**

•Make sure that the **old papers are collected back** before the new papers are distributed.

•This time another set of 20 math problems is used.

Time to start!



•During the second round of the game, teacher should observe how different students are responding to the new incentive system, i.e. the payment scheme they used. Teacher should mentally select a few students to call upon later to explain how the new incentive system altered their production process. Teacher should look for Firm A who may:

- •do all their work on one piece of paper;
- •choose to use two or three papers;
- •choose to produce the answers without using any of the 5 paper provided, illustrating a firm choosing an alternative production method;
- •choose not to produce at all.

Time's up!

- **Firm B checks the answers for Firm A and keeps the record.**

•After 5 minutes, project the answers on the screen.

•Firm B checks the answers for Firm A and keeps the record.

Play the game again!

- Another 3 minutes will be given to Firm B to produce airplanes.

Time to start!

•Let Firm B make airplanes for 3 minutes.

Time's up!

- **Calculate the total output in both rounds of production and fill in the record sheets.**

•After 3 minutes, time's up!

•Let Firm A count and record the number of airplanes made by Firm B.

In this round…

- **How many problems was Firm A able to solve in the 1st production round?**
- **Did Firm A reduce the number of papers used in production and how does this affect its outputs in the 2nd round? Why did Firm A change?**
- **Who paid for the use of blank papers between two firms?**
- **Which pair of students has more total output in the 2nd round of production?**

•Teacher can call on the Firm As that were mentally selected before and ask:

- •How many problems were you able to solve in the first production round?
- •Did you reduce the number of papers used in production and how does this affect your outputs in the second round?
- •Why did you change?
- •Who paid for the use of blank papers between the two of you?

In this round...

- Some Firm A changed its production process to conserve the valued resource (the blank papers).
- Firm A now internalizes the cost of actions.
- No matter whether Firm A has to pay for using the blank papers or gets a compensation for not using the blank papers, Firm A has internalized the external costs imposed to Firm B, that is the time used to erase the marks on the papers.

In this round...

- **Resources can be allocated more efficiently and neither good is overproduced or underproduced because:**
  - **Firm A considered the external cost of using the resources.**
  - **Firm A pays for the used papers if Firm B has the property right of the blank papers or Firm A loses compensation for not using blank papers if assume Firm A has the property right.**

In this round...

- **The total number of bonus points earned by Firm A and Firm B together increases because of an overall increase in production.**

- **The two goods: Math answers and paper airplanes were produced more efficiently.**

Differences between 2 rounds

- **In the 1st round, large quantities of math answers were produced at the expense of paper airplanes:**

1. ***Externality exists.***
2. **Math answers were *overproduced.***
3. **Paper airplanes were *underproduce .***

- **In the 2nd round, the *externality is corrected*:**

1. **The cost of producing the *externality was internalized.***
2. ***More efficient production* of the 2 goods: math answers and paper airplanes.**

Conclusion

- **How's the level of the transaction cost between Firm A and B?**

  Answer: The transaction cost and negotiation cost will change if Firm A & Firm B is only one of the firms in their industry rather than the only firm in the industry.

- **Coase Theorem explains that regardless of who owns the property rights, as long as externality is internalized, then the allocation of resources is efficient provided that the transaction costs are sufficiently low.**

Definitions

- **Externalities**
  - **– refer to the spillovers which are the consequences of the action that actors don't take into account and therefore don't influence their decision.**
- **Negative externalities**
  - **– are the detrimental consequences of the action that actors don't take into account and therefore don't influence their decision. They also refer to a divergence between private and social costs.**
- **Positive externality**
  - **– are the advantageous consequences of the action that actors don't take into account and therefore don't influence their decision. They also refer to a divergence between private and social benefits.**

Definition

- **Coase Theorem**
  - **It states that if property rights are well-defined or specified and transaction costs are zero, then**

a) the allocation of resources will be efficient as there is no problem of externalities,

b) the allocation of resources will be identical, regardless of the initial assignment of property rights.

Homework

- What is externality?
- Please give some examples of negative externality and positive externality.
- What is the definition of Coase Theorem?