### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AC</td>
<td>Average cost (LR)</td>
</tr>
<tr>
<td>AR</td>
<td>Average revenue</td>
</tr>
<tr>
<td>coll</td>
<td>colluding</td>
</tr>
<tr>
<td>comp</td>
<td>competitive</td>
</tr>
<tr>
<td>CS</td>
<td>Consumer surplus</td>
</tr>
<tr>
<td>D</td>
<td>Demand</td>
</tr>
<tr>
<td>MC</td>
<td>Marginal cost</td>
</tr>
<tr>
<td>MR</td>
<td>Marginal revenue</td>
</tr>
<tr>
<td>P</td>
<td>Price</td>
</tr>
<tr>
<td>Q</td>
<td>Quantity</td>
</tr>
<tr>
<td>Q*</td>
<td>Profit maximizing/Loss minimizing quantity</td>
</tr>
<tr>
<td>S</td>
<td>Supply</td>
</tr>
<tr>
<td>TR</td>
<td>Total revenue</td>
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</tbody>
</table>
Monopoly in comparison to competition: P is higher, Q is lower, CS is smaller.

Maximum profit where $MC = MR \rightarrow P = 7, Q^* = 2, \text{Profit} = 4$
03 Consumer surplus in the case of a monopoly

D = P = AR
MC = AC
Q

CS in the case of competition
Profit of monopolist

reduced CS in the case of monopoly
Deadweight loss

04 Loss in the case of a monopoly

D = P = AR
MC = AC
Q
MR

$P^* = \text{Loss monopoly}
\quad Q^*

05 AC and monopoly

There are increasing returns to scale well beyond the size of the market. Thus, a monopoly can produce goods at lower AC than firms under competition or oligopolistic firms. Such a monopoly is called 'natural monopoly'.
06 **Price discrimination by a monopolist**

- **Situation in the poor country**
  - $D=P=AR$
  - $MC=AC$
  - $Q^*$

- **Situation in the rich country**
  - $D=P=AR$
  - $MC=AC$
  - $Q^*$

Combined profit in the case of price discrimination

07 **Revenue maximization by a monopolist**

- $D=P=AR$
- $MC=AC$
- $Q$ where $MR = 0 \implies$ Maximum total revenue

Profit
**Collusion in the case of an oligopoly**

If oligopolists collude in a cartel, they behave like a monopolist ($P>MC$).

- $P_{\text{oligopolists}}$
- $P^*_{\text{comp}}$
- $Q^*_{\text{comp}}$
- $MR$
- $D=P=AR$
- $MC=AC$

**Oligopoly**

1. **Kinked demand curve:**
   - If an oligopolist raises $P$, other oligopolists will not follow; thus, he loses much $Q$.
   - If an oligopolist lowers $P$, other oligopolists will follow; thus, he gains only a small amount of $Q$.

2.
Prisoners’ dilemma game by two oligopolist

Outcome (pay-off): Profit

(Low output $\rightarrow$ High price
High output $\rightarrow$ Low price)

<table>
<thead>
<tr>
<th>Firm</th>
<th>Low output</th>
<th>High output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low output</td>
<td>High output</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

Dominant strategy is 'High output' (low price) for both firms.

Arguments by firm 1:
- If firm 2 chooses low output, we choose high output ($5 > 3$).
- If firm 2 chooses high output, we choose again high output ($2 > 0$).
- Therefore, irrespective of the choice of firm 2, we choose high output.

The same arguments can be made by firm 2 because the game is symmetrical.

If the oligopolists collude, they choose 'Low output' for both firms ($3 > 2$).

→ Back to questions. Click here!