1. Some characteristics of goods (and services)
   a. *Excludable*: People can be excluded from consumption (at reasonable cost), vs.
   b. *Nonexcludable*: It is difficult (impossible) to exclude anyone from consumption if anyone else is consuming it
   c. *Rival* in consumption: Consumption by one person diminishes consumption by others, vs.
   d. *Nonrival*: Consumption by one person does not diminish (the opportunity) for consumption by others

2. A Classification

<table>
<thead>
<tr>
<th>Rival</th>
<th>Nonrival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excludable</td>
<td>Private goods</td>
</tr>
<tr>
<td>Nonexcludable</td>
<td>Common Resources</td>
</tr>
</tbody>
</table>

3. Examples:
   a. Private: Most goods and services e.g. beer. If I drink a beer, you cannot drink the same beer. And I can prevent you from doing so.
   b. Public: National Defense. If I am defended by an antimissile system, so are you: You can’t be excluded and your consumption does not diminish mine. Basic (non-patentable) research. Welfare programs (poor relief) if all care about the poor.
   c. Common Resource: Ocean fish. My consumption does reduce the remaining fish available to be caught, and it is difficult to exclude any fisherman. The environment. Common grazing lands.

4. Inbetween cases:
   a. Broadcast TV
   b. Cable and Satellite TV
   c. Pay per View TV
   d. Bozeman city band concerts in Bogert Park
   e. Fireworks displays

5. The Free Rider Problem
   a. Suppose defense were provided by the private market. Who would buy it? Wouldn’t there be a great temptation to let other people pay for it, since one can’t be excluded?
   b. If people cannot be excluded, they won’t volunteer to pay (much) => result = underprovision by private market
   c. 10% of listeners donate to KEMC public radio (and most donate much less than their willingness to pay i.e. value to them)

6. Four roommates are planning to spend the weekend in their dorm room watching old movies, and they are debating how many to watch. Here is their willingness to pay for each film:

<table>
<thead>
<tr>
<th>Judd</th>
<th>Joel</th>
<th>Gus</th>
<th>Tim</th>
</tr>
</thead>
<tbody>
<tr>
<td>First film</td>
<td>$7</td>
<td>$5</td>
<td>$3</td>
</tr>
<tr>
<td>Second film</td>
<td>6</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Third film</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Fourth film</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Fifth film</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

a. Within the dorm room, is the showing of a movie a public good? Why or why not?
b. If it costs $8 to rent a movie, how many movies should the roommates rent to maximize total surplus?

c. If they choose the optimal number from part (b) and then split the cost of renting the movies equally, how much surplus does each person obtain from watching the movies?

d. Is there any way to split the cost to ensure that everyone benefits? What practical problems does this solution raise?

e. Suppose they agree in advance to choose the efficient number and to split the cost of the movies equally. When Judd is asked his willingness to pay, will he have an incentive to tell the truth? If so, why? If not, what will he be tempted to say?

f. What does this example teach you about the optimal provision of public goods?

7. The town of Wiknam has 5 residents whose only activity is producing and consuming fish. They produce fish in two ways. Each person who works on a fish farm raises 2 fish per day. Each person who goes fishing in the town lake catches \( X \) fish per day. \( X \) depends on \( N \), the number of residents fishing in the lake. In particular, \( X = 6 - N \).

   Each resident is attracted to the job that pays more fish.

   a. Why do you suppose that \( X \), the productivity of each fisherman, falls as \( N \), the number of fishermen, rises? What economic term would you use to describe the fish in the town lake? Would the same description apply to the fish from the farms? Explain.

   b. The town's Freedom Party thinks every individual should have the right to choose between fishing in the lake and farming without government interference. Under its policy, how many of the residents would fish in the lake and how many would work on fish farms? How many fish are produced?

   c. The town's Efficiency Party thinks Wiknam should produce as many fish as it can. To achieve this goal, how many of the residents should fish in the lake and how many should work on the farms? (Hint: Create a table that shows the number of fish produced—on farms, from the lake, and in total—for each \( N \) from 0 to 5.)

   d. The Efficiency Party proposes achieving its goal by taxing each person fishing in the lake by an amount equal to \( T \) fish per day. It will then distribute the proceeds equally among all Wiknam residents. (Fish are assumed to be divisible, so these rebates need not be whole numbers.) Calculate the value of \( T \) that would yield the outcome you derived in part (c).

   e. Compared with the Freedom Party's hands-off policy, who benefits and who loses from the imposition of the Efficiency Party's fishing tax?

8. The Tragedy of the Commons
   a. Unlimited access may result in overuse and environmental destruction
   b. Whales, elephants, grazing in Botswana
   c. Enforceable property rights and/or government regulation can save the commons