SOLUTIONS

1. You operate a travel company in Los Angeles that makes vacation plans for people. One of your offerings is a trip to East Lansing, MI. You are deciding how to price the vacation. You can either set one price for the transportation to East Lansing ($p_T$) and a separate price for the accommodations/entertainment at East Lansing ($p_{AE}$) or set a single price for the transportation and accommodations/entertainment ($p_{TAE}$). If you set separate prices, a person can choose to use your travel company for transportation, accommodations/entertainment, or for both. Your clientele consists of two types of customers. Type I customers value the transportation at $300 and the accommodations/entertainment at $400. Type II customers value the transportation at $250 and the accommodations/entertainment at $500. There are 20 Type I customers and 30 Type II customers. Your costs are $100 for every person you provide transportation and $300 for every person you provide accommodations/entertainment.

<table>
<thead>
<tr>
<th></th>
<th>Type I (20)</th>
<th>Type II (30)</th>
<th>Marginal Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>300</td>
<td>250</td>
<td>100</td>
</tr>
<tr>
<td>Accom/Entertainment</td>
<td>400</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td>Totals</td>
<td>700</td>
<td>750</td>
<td>400</td>
</tr>
</tbody>
</table>

a) What are your maximum profits from not bundling?
$p_T = 250$ and $p_{AE} = 500$ so profits equal $(250-100)50 + (500-300)30 = 13500$.

b) What are your maximum profits from bundling?
$p_{TAE} = 700$ so profits equal $(700-400)50 = 15000$.

c) What are your maximum profits from mixed bundling?
$p_T = 300$ and $p_{TAE} = 750$ so profits equal $(300-100)20 + (750-400)30 = 14500$.

2. This question is based on my experience when I visited TC Timber.

TC Timber is a company located in Skaneateles that manufactures wooden train sets (similar to those produced by Brio). Suppose TC Timber has two types of customers: grandparents and parents. Assume that TC Timber cannot distinguish grandparents from parents. The grandparents are willing to pay a maximum of $500 for a wooden train set and parents are willing to pay a maximum of $300 for a wooden train set (assuming they do not have to wait in line in order to purchase the train set). There are 200 grandparents and 300 parents. Every year TC Timber has a sale the first weekend in December where they sell the wooden train set for a sale price. For simplicity, assume grandparents and parents only demand a single train set (as we assumed in class).

a) During the sale (i.e., the first weekend in December), people buying a train set must wait 2 hours in line (there are no lines other than this sale weekend). Suppose the opportunity cost per hour associated with waiting in line is $100 for grandparents and $25 for parents. Assume that TC Timber’s marginal cost of a wooden train set is constant at $50. What price should TC Timber charge for the train set (i.e., the non-sale price) and what should be the sale price? SHOW CALCULATIONS AND EXPLAIN.

For the parents to buy at the sale price compared to the non-sale price, the difference between the prices must be at least $50. In addition, the sale price cannot be greater than 300-50=250 for
the parents to buy the train set at the sale price. For the grandparents to buy at the sale price compared to the non-sale price, the difference between the prices must be at least $200. Therefore, profits are maximized if the sale price is set at 250 and the non-sale price is set at 450. Profits would then be \((450-50)\times200+(250-50)\times300=140,000\).

Maximum profits if TC timber only set a single, non-sale price would be 125,000 \(\{(300-50)\times500\}\) where the price selected would be 300.

b) Now suppose that TC Timber can also choose whether to have one, two or three cashiers working during the sale (i.e., the first weekend in December). If they have 1 cashier working, people would have to wait 3 hours. If they have 2 cashiers working, people would have to wait 2 hours. If they have 3 cashiers working, people would have to wait 1 hour. Assume the same opportunity costs and the same costs for TC Timber as in part a). For simplicity, assume that the cost of a cashier is zero. What price should TC Timber charge for the train set (i.e., the non-sale price), how many cashiers should TC Timber have working during the sale and what should be the sale price? SHOW CALCULATIONS AND EXPLAIN.

Maximum profits if have 3 cashiers and people have to wait 1 hour to obtain sale price:
Profits are maximized by setting non-sale price of 375 and sale price of 275.
Profits would then be \((375-50)\times200+(275-50)\times300=132,500\)

Maximum profits if have 2 cashiers and people have to wait 2 hours to obtain sale price:
As above, profits are maximized by setting non-sale price of 450 and sale price of 250.
Profits would then be \((450-50)\times200+(250-50)\times300=140,000\)

Maximum profits if have 1 cashier and people have to wait 3 hours to obtain sale price:
Profits are maximized by setting non-sale price of 500 and sale price of 225.
Profits would then be \((500-50)\times200+(225-50)\times300=142,500\)

3. Here is a story many of you have heard.

There are two friends taking Economics at MSU. Both had done pretty well on all of the homeworks and the midterm, so that going into the final they had a solid A. They were so confident the weekend before the final that they decided to go to a party in Chicago. The party was so good that they overslept all day Sunday, and got back too late to study for the Economics final that was scheduled for Monday morning. Rather than take the final unprepared, they went to the professor with a sob story. They said they had gone to Chicago and had planned to come back in plenty of time to study for the final but had had a flat tire on the way back. Because they did not have a spare, they had spent most of the night looking for help. Now they were really tired, so could they please have a makeup final the next day? The professor thought it over and agreed. The two studied all of Monday evening and came well prepared on Tuesday morning. The professor placed them in separate rooms and handed the test to each. The first question on the first page, worth 10 points, was very easy. Each of them wrote a good answer, and greatly relieved, turned the page. It had just one question, worth 90 points. It was: “Which tire?”

Suppose that each student’s “payoff” is 100 (because they receive an A in the class) if they answer the second question the same and each student’s “payoff” is 30 (because they receive a C in the class) if they answer the second question differently.
a) Depict the above situation as a normal form game.

<table>
<thead>
<tr>
<th>Student 1</th>
<th>Front-Left</th>
<th>Front-Right</th>
<th>Back-Left</th>
<th>Back-Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front-Left</td>
<td>100,100</td>
<td>30,30</td>
<td>30,30</td>
<td>30,30</td>
</tr>
<tr>
<td>Front-Right</td>
<td>30,30</td>
<td>100,100</td>
<td>30,30</td>
<td>30,30</td>
</tr>
<tr>
<td>Back-Left</td>
<td>30,30</td>
<td>30,30</td>
<td>100,100</td>
<td>30,30</td>
</tr>
<tr>
<td>Back-Right</td>
<td>30,30</td>
<td>30,30</td>
<td>30,30</td>
<td>100,100</td>
</tr>
</tbody>
</table>


b) Does either student have a dominant strategy? If so, please identify the dominant strategy.

*Neither student has a dominant strategy.*

c) Identify all Pure Strategy Nash Equilibria.

*There are 4 Pure Strategy Nash Equilibria. For both students to select Front-Left, for both students to select Front-Right, for both students to select Back-Left, or for both students to select Back-Right.*

4. Software Developers Inc. and AMC Applications Inc. are two companies developing statistical software programs. These companies must simultaneously decide whether to develop software that operates on the Unix operating system, Microsoft’s Windows operating system or an object-orientated operating system. The table below indicates Software Developers Inc. and AMC Applications Inc. profits depending on the operating system they develop their statistical software for.

<table>
<thead>
<tr>
<th>Software Developers Inc.</th>
<th>AMC Applications Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unix</td>
</tr>
<tr>
<td>Unix</td>
<td>40,50</td>
</tr>
<tr>
<td>Windows</td>
<td>45,40</td>
</tr>
<tr>
<td>Object-Orientated</td>
<td>25,60</td>
</tr>
</tbody>
</table>

a) Does Software Developers Inc. or AMC Applications Inc. have a dominant strategy? Explain.

*No, the best strategy of Software Developers Inc. depends on the strategy of AMC Applications Inc. and the best strategy of AMC Applications Inc. depends on the strategy of Software Developers Inc.*

b) Identify the Nash Equilibrium/Equilibria.

*The first strategy listed identifies Software Developers Inc. strategy and the second is AMC Applications Inc. strategy.*

Two Nash Equilibria:

*$(Windows, Windows)$

*$(Object-Orientated, Object-Orientated)$*

c) Can you explain why profits may be greater for both firms when they develop software for the same operating system?

*There are likely to be benefits associated with having a standardized operating system.*