Solutions to Assignment I

11.1 Asphalt and Concrete Pavements

a) Since concrete and asphalt road beds have different life spans, they cannot be compared over one life span each. They can be considered over multiple life spans, repeating the projects until a common multiple of years is reached. Practically, this can be done by finding close multiples around 30 or more years, since the present values of sums further in the future are insignificant. The calculations may be quickly performed by considering the difference between the two cash flows. Choosing 3 life spans for asphalt and 2 for concrete (51 and 54 years respectively) gives sufficiently close projects lives.

Figure 1 gives the cash flow of the costs and savings of initially choosing concrete over asphalt, in terms of dollars per square yard. The initial extra cost of the concrete is $21 - $17.8 = $3.2. Note that by focusing on the incremental difference of one alternative over the other, rather than on each separately, there are fewer and simpler calculations.

\[
NPV(\text{concrete over asphalt}) = -3.2 + \frac{17.8}{1.1^{17}} - \frac{17.8}{1.1^{27}} + \frac{17.8}{1.1^{34}} + \frac{17.8}{1.1^{51}} - \frac{17.8}{1.1^{54}} = -$0.37 / yd^2
\]

For concrete to be as inexpensive as asphalt, the cost of concrete must be reduced by...
$0.37 per square yard. At $20.63 per square yard, NPV=0, and both materials have equivalent costs over time.

b) The costs are equal at r = 9.2%

c) If the national government pays one half of the initial cost of the road:
NPV = $0.37 + 3.2/2 = $1.23/yd^2
So choose concrete.

If the discount rate is 6%, NPV = $2.03/ yd^2
So choose concrete.

12.9 Hi-Tacky Corporation

The discount rate should be the return of the best alternative investment opportunity. The actual return is before tax, and we have to take out the inflation factor because the savings of $5000 are in current dollars. So the discount rate is:

12% × 2 − 8% = 16%

13.1 New Product Line

a)

<table>
<thead>
<tr>
<th>Product</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV($10^3$)</td>
<td>22.5</td>
<td>25.8</td>
<td>27.6</td>
<td>C,B,A</td>
</tr>
<tr>
<td>B/C</td>
<td>1.64</td>
<td>1.52</td>
<td>1.31</td>
<td>A,B,C</td>
</tr>
<tr>
<td>IRR</td>
<td>0.232</td>
<td>0.202</td>
<td>0.205</td>
<td>A,B,C</td>
</tr>
</tbody>
</table>

b) Product A should be chosen on the basis of B/C ratio or IRR. NPV is not an appropriate criterion when the levels of investment are different.