Agricultural Economics
Fall 2012
Exam II

1. A. You just started your first job and are making $45,000 per year. Assuming your income increases at the rate of 6 percent per year (3 percent cost of living, 3 percent merit increase), what would your annual income be in 40 years? (10 points)

\[ V_{0} = 45,000 \times (SPFV) = 45,000 \times (10.2857) \]
\[ = 462,856.50 \]

-1 arithmetic mistake
-5 for wrong factor

B. Use your answer from part A and assume you expect to retire after 40 years. What would you need to have in a retirement account at the time you retire if you expect to live 25 years after you retire and want to generate the same annual income during retirement that you were earning when you retired? Assume you won’t be able to put any more money in the account after you retire but that the money in the account earns an annual rate of return of 5 percent. (10 points)

\[ V_{0} = 462,856.50 \times (USPV) = 462,856.50 \times (14.0939) \]
\[ = 6,523,453.23 \]

-1 arithmetic
-5 wrong factor
2. Given the following information, what is the net present value of the investment? Assume your required rate of return is 10 percent. (20 points)

<table>
<thead>
<tr>
<th>Initial investment</th>
<th>$100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning horizon</td>
<td>5 years</td>
</tr>
<tr>
<td>Net after tax terminal value</td>
<td>$140,000</td>
</tr>
<tr>
<td>Annual net after tax cash flows:</td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>6,000</td>
</tr>
<tr>
<td>Year 2</td>
<td>7,000</td>
</tr>
<tr>
<td>Year 3</td>
<td>8,000</td>
</tr>
<tr>
<td>Year 4</td>
<td>9,000</td>
</tr>
<tr>
<td>Year 5</td>
<td>10,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>time</th>
<th>NCF</th>
<th>DF</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-100,000</td>
<td>1</td>
<td>-100,000</td>
</tr>
<tr>
<td>1</td>
<td>6,000</td>
<td>.9091</td>
<td>5,454.60</td>
</tr>
<tr>
<td>2</td>
<td>7,000</td>
<td>.8264</td>
<td>5,784.80</td>
</tr>
<tr>
<td>3</td>
<td>8,000</td>
<td>.7513</td>
<td>6,014.40</td>
</tr>
<tr>
<td>4</td>
<td>9,000</td>
<td>.6830</td>
<td>6,147</td>
</tr>
<tr>
<td>5</td>
<td>10,000 + 140,000</td>
<td>.6209</td>
<td>93,135</td>
</tr>
</tbody>
</table>

\[
\text{NPV} = 16,531.80
\]

- 1 arithmetic mistake
- 2 for each wrong factor
- 2 for leaving out terminal value
3. Assume you have the opportunity to buy some rental property. Again, assume your required rate of return is 10 percent. Given the following information, should you buy the rental property or make the investment in problem 2? (20 points)

Initial investment $110,000
Planning horizon 9 years
Net after tax terminal value $180,000
Annual net after tax cash flows:
Years 1-9 $9,000

\[ #2 \quad NPV = 16,531.80 \quad A_{2e} = \frac{16,531.80}{\text{USPV}_{10\%, 9}} = \frac{16,531.80}{3.7908} = 4,361.03 \]

\[ #3 \quad \begin{array}{c|c|c|c|c}
\text{Time} & \text{NCF} & \text{DF} & \text{PV} \\
0 & -110,000 & 1 & -110,000 \\
1-9 & 9,000 & 5.7590 & 51,831 \\
9 & 180,000 & .4241 & 76,338 \\
\hline
\text{NPV} & \text{18,169} & \\
\end{array} \]

\[ A_{3e} = \frac{18,169}{\text{USPV}_{10\%, 9}} = \frac{18,169}{5.7590} = 3,154.89 \]

Choose investment in #2

- 1 arithmetic mistake
- 2 wrong factors
- 3 not choosing #2 or #3
- 10 not calculating annuity equivalent
- 3 not using correct USPV to calculate annuity equivalent
4. What is the internal rate of return on the rental property in problem 3? (20 points)

\[ NPV = 18,169 \]

\[
\begin{array}{c|c|c|c|c}
\text{Time} & \text{NCF} & \text{DF} & \text{PV} \\
0 & -110,000 & 1 & -110,000 \\
1-9 & 9000 & 5.3282 & 47,953.80 \\
9 & 180,000 & .3606 & 64,908 \\
\hline
13/0 & 0 & -110,000 & 1 & -110,000 \\
1-9 & 9000 & 5.1317 & 46,185.30 \\
9 & 180,000 & .3329 & 59,922 \\
\hline
\end{array}
\]

\[
\begin{pmatrix}
12.7 \% \\
13 \% \\
\end{pmatrix}
\begin{pmatrix}
2861.80 \\
0 \\
-3892.70 \\
\end{pmatrix}
\]

\[
\text{IRR} = 12.7\% + \left( \frac{2861.80}{6754.50} \right) \times 1\% = 12.424\%
\]
5. Assume you are considering buying a specialized farm equipment dealership. The cost would be $1,500,000. You are able to put 30 percent down, but would need to finance the balance on a 5 year loan. Your bank is willing to loan you the money at a 7% annual interest rate and would require equal annual payments, including principal and interest. The investment would be depreciated over 10 years using straight line depreciation and assuming no salvage value. Your projected annual net before tax cash flows would be $450,000 and $600,000 in year 1 and 2, respectively, before debt service. Your marginal income tax rate is 25 percent. Calculate the annual net after tax cash flows for years 1 and 2. (20 points)

\[
dep = \frac{1,500,000}{10} = 150,000
\]

\[
down \text{ payment} = 1,500,000 \times 0.3 = 450,000
\]

\[
loan = 1,500,000 - 450,000 = 1,050,000
\]

\[
payment = \frac{1,050,000}{\frac{79.05}{1.002}} = 256,085.07
\]

<table>
<thead>
<tr>
<th>Beg Bal</th>
<th>Payment</th>
<th>Int</th>
<th>Prin</th>
<th>End Bal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1,050,000 256,085.07 73,500 182,585.07 867,414.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 867,414.93 256,085.07 60,719.05 195,366.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Year 1**

\[
NBTCF = 450,000
\]

\[
TCF = 450,000 - 150,000 - 73,500 = 226,500
\]

\[
TAX = 226,500 \times 0.25 = 56,625
\]

\[
NATCF = 450,000 - 256,085.07 - 56,625 = 137,289.93
\]

**Year 2**

\[
NBTCF = 600,000
\]

\[
TCF = 600,000 - 150,000 - 60,719.05 = 389,280.95
\]

\[
TAX = 389,280.95 \times 0.25 = 97,320.24
\]

\[
NATCF = 600,000 - 256,085.07 - 97,320.24 = 246,594.69
\]

- (arithmetic mistake -4 for each wrong loan payment -3 principal and interest breakdown wrong -5 for each wrong calculation of NATCF - wrong depreciation)
Bonus Question:

In the readings book, on pages 6-11, there are three short articles. The second article "Success in the Future" by Bill Burgess listed 16 qualities of people who are successful in both their personal and their business lives. List 3 of them. (3 points)

see attached

1@
1. a) When you retire, you want to have enough money in your retirement account to generate an annual income of $360,000 and expect to live 25 years after you retire. You won’t be able to put any more into the account after you retire. If the annual rate of return you expect to earn on the balance in the account is 5 percent, how much will you need to have at the time you retire? (10 points)

\[ 360,000 \times (u_{25.0\%}) = 360,000 \times (14.0939) = 5,073,804 \]

-5 for not using UPV
-2 for using wrong UPV
-1 arithmetic

b) If you can earn an 8 percent annual return on your investment, how much will you need to save each year to accumulate the amount you determined in part (a), if you plan to retire in 40 years? (10 points)

\[ 5,073,804 = p \times (u_{40.0\%}) = p \times (259.057) \]

\[ p = \frac{5,073,804}{259.057} = 19,585.67 \]

-5 for not using USFV
-2 for using wrong USFV
-1 arithmetic
3. What is the internal rate of return on the duplex in problem #2? (20 points)

<table>
<thead>
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<th>170,000</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>10</td>
<td>U$SpV$</td>
<td>S$Pv$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0188</td>
<td>0.2472</td>
</tr>
<tr>
<td></td>
<td></td>
<td>69,225.60</td>
<td>42,024</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-2750.40</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>12,000</th>
<th>170,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-10</td>
<td>U$SpV$</td>
<td>S$Pv$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.2161</td>
<td>0.2677</td>
</tr>
<tr>
<td></td>
<td></td>
<td>62,593.20</td>
<td>45,849</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,442.20</td>
<td></td>
</tr>
</tbody>
</table>

\[
19\% \begin{bmatrix}
[14\% & 3,442.20 \\
15\% & -2750.40
\end{bmatrix} = 3,442.20
\]

\[
IRR = 14\% + \left( \frac{3,442.20}{6192.60} \right) 19\% = 14.556\%
\]

- 1 arithmetic mistake
- 3 for not narrowing interpolation range as far as possible
- 3 for using a wrong factor in calculating NPV
2. You have the opportunity to invest in either a duplex or a lawn care business. Which would you prefer if your required rate of return is 12 percent? (20 points)

<table>
<thead>
<tr>
<th></th>
<th>Duplex</th>
<th>Lawn Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cash outlay</td>
<td>$105,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Planning horizon</td>
<td>10 years</td>
<td>7 years</td>
</tr>
<tr>
<td>Net annual after tax cash flows</td>
<td>$12,000/year</td>
<td>$15,000/year</td>
</tr>
<tr>
<td>Net after tax terminal value</td>
<td>$170,000</td>
<td>$15,000</td>
</tr>
</tbody>
</table>

**Duplex**

\[
\begin{align*}
\text{Time} & \quad \text{NCF} & \quad \text{DF} & \quad \text{PV} \\
0 & -105,000 & 1 & -105,000 \\
1-10 & 12,000 & \text{USPV} & 5.6502 & 67,802.40 \\
10 & 170,000 & \text{SPV} & -322 & 54,740 \\
\end{align*}
\]

\[
A_{eq} = \frac{17,542.40}{5.6502} = 3,104.74
\]

**Lawn Care**

\[
\begin{align*}
\text{Time} & \quad \text{NCF} & \quad \text{DF} & \quad \text{PV} \\
0 & -60,000 & 1 & -60,000 \\
1-7 & 15,000 & \text{USPV} & 4.5638 & 68,457 \\
7 & 15,000 & \text{SPV} & 0.4523 & 6,784.50 \\
\end{align*}
\]

\[
A_{eq} = \frac{15,241.50}{4.5638} = 3,339.65
\]

\[
3,339.65 > 3,104.74 \quad \text{Choose Lawn Care}
\]

- 8 for not calculating annuity equivalents
- 2 for not stating which you would choose
- 4 for using same USPV for both investments
- 3 for using incorrect factors in calculating an investment's NPV
- 1 arithmetic mistake
4. Assume that in order to finance your education and provide a place for you to live during your 5 years at A&M, your parents decide to buy 40 acres and build two 15 acre fee fishing lakes. They are also building a small modular home on the property. Given the information below and assuming a 12 percent required rate of return, would this be an acceptable investment? (20 points)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cash outlay</td>
<td>$160,000</td>
</tr>
<tr>
<td>Planning horizon</td>
<td>5 years</td>
</tr>
<tr>
<td>Net annual after tax cash flows</td>
<td>$25,000/year</td>
</tr>
<tr>
<td>Net after tax terminal value</td>
<td>$200,000</td>
</tr>
</tbody>
</table>

\[
\begin{array}{cccc}
0 & -160,000 & 1 & -160,000 \\
1-5 & 25,000 & 3.6048 & 90,120 \\
5 & 200,000 & 0.6210 & 113,480 \\
\hline
43,600 & > 0 & & \\
\end{array}
\]

Yes, good investment

-3 for not saying if investment is acceptable
-3 for using wrong discount factor
5. Your father has told you he is considering building a small warehouse. The cost would be $250,000. He plans to put $50,000 down and finance the balance on a 15 year mortgage requiring equal annual payments, including principal and interest. The annual interest rate on the loan would be 8 percent. He assumes a $100,000 salvage value for tax purposes and intends to depreciate the building over 15 years using straight line depreciation. The net before tax cash flows, before considering the loan payment, are expected to be $32,000 in year 1 and then to increase by $2000 each year thereafter. His tax rate is 25 percent. Calculate the next after tax cash flows for years 1 and 2. (20 points)

\[
\text{Dep} = \frac{250,000 - 100,000}{15} = 10,000
\]

\[
\text{Loan paymt} = \frac{250,000 - 50,000}{\text{USPV}}, 8\% , 15 = \frac{200,000}{8.5595} = 23,365.85
\]

<table>
<thead>
<tr>
<th>Year</th>
<th>Paymt</th>
<th>Int</th>
<th>Prin</th>
<th>Remaining Bal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>200,000</td>
</tr>
<tr>
<td>1</td>
<td>23,365.85</td>
<td>16,000</td>
<td>7,365.85</td>
<td>194,634.15</td>
</tr>
<tr>
<td>2</td>
<td>23,365.85</td>
<td>15,410.73</td>
<td>7,955.12</td>
<td>184,679.02</td>
</tr>
</tbody>
</table>

\[
\text{NBTCF}_1 = 32,000
\]
\[
\text{TCF}_1 = 32,000 - 10,000 - 16,000 = 6,000
\]
\[
\text{Tax}_1 = 6,000 \times 0.25 = 1,500
\]
\[
\text{NATCF}_1 = 32,000 - 23,365.85 - 1,500 = 7,134.15
\]

\[
\text{NBTCF}_2 = 34,000
\]
\[
\text{TCF}_2 = 34,000 - 10,000 - 15,410.73 = 8,589.27
\]
\[
\text{Tax}_2 = 8,589.27 \times 0.25 = 2,147.32
\]
\[
\text{NATCF}_2 = 34,000 - 23,365.85 - 2,147.32 = 8,486.83
\]
Agricultural Economics 330  
Fall 2014  
Exam II

1. A. You just started your first job and are earning $40,000 per year. Assume you plan to retire in 40 years and want a retirement income equal to your current standard of living. What would your annual retirement income need to be if the rate of inflation was 5 percent per year for the next 40 years? (10 points)

\[ V = \frac{40,000}{(1 + 0.05)^{40}} = \frac{40,000}{1.05^{40}} = 281,600 \]

- 1 arithmetic mistake
- 5 using wrong factor

B. You need $200,000 in 18 years in order to put your only child through college. How much would you need to save each year if the money you invested earned a 7 percent annual rate of return? (10 points)

\[ 200,000 = p \left( \frac{1 - (1 + 0.07)^{-18}}{0.07} \right) \]

\[ p = \frac{200,000}{33.990} = 5882.53 \]

- 1 arithmetic mistake
- 5 using wrong factor
You have the opportunity to go into a partnership with 3 other students. The partnership involves forming a business where you could work during the 6 years it will take you to earn your bachelors degree. It will require an initial cash investment of $5,000. Based on your 6 year planning horizon, the annual net after tax cash flows are expected to be:

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$3,600</td>
</tr>
<tr>
<td>2</td>
<td>4,200</td>
</tr>
<tr>
<td>3</td>
<td>4,800</td>
</tr>
<tr>
<td>4</td>
<td>5,400</td>
</tr>
<tr>
<td>5</td>
<td>6,000</td>
</tr>
<tr>
<td>6</td>
<td>6,600</td>
</tr>
<tr>
<td></td>
<td>$10,000</td>
</tr>
</tbody>
</table>

At the end of the sixth year, your expected net after tax cash terminal value from the sale of the business is $10,000. If your required rate of return is 10 percent, should you make this investment? (20 points)

<table>
<thead>
<tr>
<th>Time</th>
<th>NCF</th>
<th>DF</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-5000</td>
<td></td>
<td>-5000</td>
</tr>
<tr>
<td>1</td>
<td>3600</td>
<td>.9091</td>
<td>3272.76</td>
</tr>
<tr>
<td>2</td>
<td>4200</td>
<td>.8264</td>
<td>3470.88</td>
</tr>
<tr>
<td>3</td>
<td>4800</td>
<td>.7513</td>
<td>3606.24</td>
</tr>
<tr>
<td>4</td>
<td>5400</td>
<td>.6830</td>
<td>3688.20</td>
</tr>
<tr>
<td>5</td>
<td>6000</td>
<td>.6209</td>
<td>3725.50</td>
</tr>
<tr>
<td>6</td>
<td>6600 + 10,000</td>
<td>.5645</td>
<td>9370.70</td>
</tr>
</tbody>
</table>

Total NPV = 22,134.18

**NPV:** $21,798.48

**Yes, make investment**

- Arithmetic mistakes
- For each wrong factor (-8 if they use SPFV rather than SPPV factor)
- For leaving out terminal value
- For forgetting to answer whether they would make investment
2. Given the following information, which of the investments would you prefer if your required rate of return is 12 percent? (20 points)

<table>
<thead>
<tr>
<th></th>
<th>S</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cash outlay</td>
<td>$60,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>Investment life</td>
<td>5 years</td>
<td>8 years</td>
</tr>
<tr>
<td>Net after tax terminal value</td>
<td>-0-</td>
<td>$80,000</td>
</tr>
<tr>
<td>Net annual after tax cash flows:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>$18,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Year 2</td>
<td>18,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Year 3</td>
<td>18,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Year 4</td>
<td>18,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Year 5</td>
<td>18,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Year 6</td>
<td>-</td>
<td>4,000</td>
</tr>
<tr>
<td>Year 7</td>
<td>-</td>
<td>4,000</td>
</tr>
<tr>
<td>Year 8</td>
<td>-</td>
<td>4,000</td>
</tr>
</tbody>
</table>

\[
Ae_s = \frac{4,886.40}{3.6048_{\text{USPV}_{12\%,5}}} = 1355.53
\]

\[
Ae_m = \frac{12,182.40}{4.9676_{\text{USPV}_{12\%,8}}} = 2452.37
\]

Choose M.
What is the internal rate of return for investment M in problem #2? (20 points)

Already knew from #2 that for \( r = 12\% \):

\[ NPV = 12,182.40 \]

<table>
<thead>
<tr>
<th>Time</th>
<th>NCF</th>
<th>DF</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-40,000</td>
<td>1</td>
<td>-40,000</td>
</tr>
<tr>
<td>1-8</td>
<td>40,000</td>
<td>4.0776</td>
<td>16,310.40</td>
</tr>
<tr>
<td>8</td>
<td>80,000</td>
<td>0.2660</td>
<td>21,280</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2409.60</td>
</tr>
<tr>
<td>0</td>
<td>-40,000</td>
<td>1</td>
<td>-40,000</td>
</tr>
<tr>
<td>1-8</td>
<td>40,000</td>
<td>4.3436</td>
<td>17,374.40</td>
</tr>
<tr>
<td>8</td>
<td>80,000</td>
<td>0.3050</td>
<td>24,400</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1774.40</td>
</tr>
<tr>
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<td>-40,000</td>
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<tr>
<td>1-8</td>
<td>40,000</td>
<td>4.2072</td>
<td>16,828.80</td>
</tr>
<tr>
<td>8</td>
<td>80,000</td>
<td>0.2848</td>
<td>22,784</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>387.20</td>
</tr>
</tbody>
</table>

\[
\begin{aligned}
\text{IRR} &= 16^\circ + \left( \frac{1774.40}{2161.60} \right) 17^\circ = 16.821 \%
\end{aligned}
\]
4. Consider an investment that would require you to make an initial cash investment of $30,000 and borrow an additional $70,000. The loan is to be repaid in 10 equal annual payments, including principal and interest, at an interest rate of 8 percent. Assume a $20,000 salvage value and 10 year straight line depreciation based on the original cost of $100,000. The net annual before tax cash flows are expected to be $20,000 per year for years 1-10, before debt servicing requirements. If your marginal income tax rate is 28 percent, what would be the annual net after tax cash flows for year 1 and 2? (20 points)

\[
\text{loan} \quad P = \frac{70,000}{\text{PV}_{8\%,10}} = \frac{70,000}{6.7101} = 10,432.04
\]

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>10,432.04</td>
<td>5600</td>
<td>4832.04</td>
<td>65,167.96</td>
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<tr>
<td>2</td>
<td>65,167.96</td>
<td>5213.44</td>
<td>5218.60</td>
<td>59,949.36</td>
</tr>
</tbody>
</table>

\[
\text{annual dep} = \frac{100,000 - 20,000}{10} = 8000
\]

\[
\text{NATCF}_1 = 20,000
\]

\[
\text{DCF} = 20,000 - 8000 - 5600 = 6400
\]

\[
\text{TAX} = 6400 \times 0.28 = 1792
\]

\[
\text{NATCF}_1 = 20,000 - 1792 - 5600 - 4832.04 = 7775.96
\]

\[
\text{NATCF}_2 = 20,000
\]

\[
\text{DCF} = 20,000 - 8000 - 5213.44 = 6786.56
\]

\[
\text{TAX} = 6786.56 \times 0.28 = 1900.24
\]

\[
\text{NATCF}_2 = 20,000 - 1900.24 - 5213.44 - 5218.60 = 7667.72
\]

-1 arithmetic mistakes
-3 depreciation wrong
-4 loan payment wrong
-3 payment breakdown wrong
-5 for each incorrect calculation of NATCF