Problem 5-1
(a) Compute the payments at the beginning of each year of the PLAM.

<table>
<thead>
<tr>
<th>Year</th>
<th>BOY Balance</th>
<th>Annual Interest Rate</th>
<th>Monthly Interest Rate (2)/12</th>
<th>Payments</th>
<th>Monthly Interest (3) x (1)</th>
<th>Monthly Amort (4) -(5)</th>
<th>Annual Amort (1) - (7)</th>
<th>EOY Balance</th>
<th>Inflation Adjusted Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$95,000</td>
<td>4.00%</td>
<td>0.33%</td>
<td>$453.54</td>
<td>$316.67</td>
<td>$136.88</td>
<td>$1,672.98</td>
<td>$93,327</td>
<td>$98,927</td>
</tr>
<tr>
<td>1</td>
<td>98,927</td>
<td>4.00%</td>
<td>0.33%</td>
<td>480.76</td>
<td>329.76</td>
<td>151.00</td>
<td>1,845.61</td>
<td>97,081</td>
<td>102,906</td>
</tr>
<tr>
<td>3</td>
<td>102,906</td>
<td>4.00%</td>
<td>0.33%</td>
<td>509.60</td>
<td>343.02</td>
<td>166.58</td>
<td>2,036.05</td>
<td>100,870</td>
<td>106,922</td>
</tr>
<tr>
<td>4</td>
<td>106,922</td>
<td>4.00%</td>
<td>0.33%</td>
<td>540.18</td>
<td>356.41</td>
<td>183.77</td>
<td>2,246.15</td>
<td>104,676</td>
<td>110,956</td>
</tr>
<tr>
<td>5</td>
<td>110,956</td>
<td>4.00%</td>
<td>0.33%</td>
<td>572.59</td>
<td>369.85</td>
<td>202.73</td>
<td>2,477.92</td>
<td>108,479</td>
<td>114,987</td>
</tr>
</tbody>
</table>

(b) The loan balance at the end of the fifth year = $108,479.

(c) IRR(CF1, CF2, …CFn)

\[
\text{IRR} = \frac{\sum CF_j}{\sum n_j CF_j} \times \frac{12}{n} \times 100%
\]

\[
\begin{align*}
453.54 & \quad n = 12 \\
480.76 & \quad n = 12 \\
509.60 & \quad n = 12 \\
540.18 & \quad n = 12 \\
572.59 & \quad n = 11 \\
572.59 + 114,987 & \quad n = 1 \\
\end{align*}
\]

Solve for the annual IRR:

\[
0.85\% \times 12 = 11.11\%
\]

Problem 5-2

<table>
<thead>
<tr>
<th>Year</th>
<th>BOY Balance</th>
<th>Annual Interest Rate</th>
<th>Monthly Interest Rate (2)/12</th>
<th>Payments</th>
<th>Monthly Interest (3) x (1)</th>
<th>Monthly Amort (4) -(5)</th>
<th>Annual Amort (1) - (7)</th>
<th>EOY Balance</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$200,000</td>
<td>6.00%</td>
<td>0.50%</td>
<td>$1,199.10</td>
<td>$1,000.00</td>
<td>$199.10</td>
<td>$2,456.02</td>
<td>$197,544</td>
<td>$195,370</td>
</tr>
<tr>
<td>2</td>
<td>$197,544</td>
<td>7.00%</td>
<td>0.58%</td>
<td>$1,327.75</td>
<td>$1,152.34</td>
<td>$175.41</td>
<td>$2,173.82</td>
<td>$195,370</td>
<td>$195,370</td>
</tr>
</tbody>
</table>
(a)
Monthly Payment = $1,199.10

(b)
Loan balance at EOY 1 = $197,544

(c)
Monthly Payment = $1,327.75

(d)
Loan balance at EOY 2 = $195,370

(e)
Monthly Payment for year 1 = $1,000

(f)
Monthly Payment for year 2 = $1,166.67

Problem 5-3

<table>
<thead>
<tr>
<th>Year</th>
<th>Balance</th>
<th>Annual Interest Rate</th>
<th>Monthly Interest Rate (2)/12</th>
<th>Monthly Interest Rate (3) x (1)</th>
<th>Monthly Amort</th>
<th>Annual Amort</th>
<th>EOY Balance (1) - (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$150,000</td>
<td>7.00%</td>
<td>0.58%</td>
<td>$997.95</td>
<td>$875.00</td>
<td>$122.95</td>
<td>$148,476</td>
</tr>
<tr>
<td>1</td>
<td>148,525</td>
<td>7.00%</td>
<td>0.58%</td>
<td>$997.95</td>
<td>$866.11</td>
<td>$131.84</td>
<td>$146,842</td>
</tr>
<tr>
<td>2</td>
<td>146,942</td>
<td>7.00%</td>
<td>0.58%</td>
<td>$997.95</td>
<td>$856.58</td>
<td>$141.37</td>
<td>$145,090</td>
</tr>
<tr>
<td>3</td>
<td>145,244</td>
<td>6.00%</td>
<td>0.50%</td>
<td>$905.34</td>
<td>$725.45</td>
<td>$179.89</td>
<td>$142,871</td>
</tr>
</tbody>
</table>

(a)
Monthly Payment = $997.95

Loan Balance EOY 3 = $145,244

(b)
New Monthly Payment = $906.30

(c)
Interest only monthly payment = $875

Monthly payments in year 4 = $935.98
## Problem 5-4

<table>
<thead>
<tr>
<th>Year</th>
<th>Balance (BOY)</th>
<th>Annual Interest Rate</th>
<th>Monthly Interest Rate</th>
<th>Monthly Interest x (1)</th>
<th>Monthly Amort.</th>
<th>Annual Amort.</th>
<th>EOY Balance (1) - (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$100,000</td>
<td>2.00%</td>
<td>0.17%</td>
<td>$423.85</td>
<td>$166.67</td>
<td>$257.19</td>
<td>$3,114.70</td>
</tr>
<tr>
<td>1</td>
<td>$96,885</td>
<td>6.00%</td>
<td>0.50%</td>
<td>$635.55</td>
<td>$484.43</td>
<td>$151.12</td>
<td>$1,864.15</td>
</tr>
<tr>
<td>2</td>
<td>$93,708</td>
<td>6.00%</td>
<td>0.50%</td>
<td>$617.95</td>
<td>$452.33</td>
<td>$165.62</td>
<td>$2,043.02</td>
</tr>
</tbody>
</table>

(a) Monthly payment during 1 year = $423.85

(b) Monthly payment in 2 year = $635.55

(c) Percentage increase in monthly payment = 50%

(d) Monthly payments at beginning of year 4 = $ 617.95
Problem 5-5

(a)

Interest only payments for the 1 year = $833.33

(b) The loan balance is $200,000. To reset the interest rate at 6% and to amortize the loan over the remaining 27 years (or 324 months) we have:

\[
\begin{align*}
PV & = -200,000 \\
\text{i} & = \frac{6}{12} \\
FV & = 0 \\
n & = 324 \\
\text{Solve} \quad PMT & = 1,247.97
\end{align*}
\]

Problem 5-6

Compute the payments, loan balance, and yield for an unrestricted ARM

Principal = $150,000
Points = 2.00%
Term = 30 years
Initial Rate = 6.0%

<table>
<thead>
<tr>
<th>Year</th>
<th>Payments</th>
<th>EOY Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$150,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>1</td>
<td>148,158</td>
<td>$148,158</td>
</tr>
<tr>
<td>2</td>
<td>147,043</td>
<td>$147,043</td>
</tr>
<tr>
<td>3</td>
<td>146,126</td>
<td>$146,126</td>
</tr>
<tr>
<td>4</td>
<td>145,282</td>
<td>$145,282</td>
</tr>
</tbody>
</table>

IRR (CF1, CF2, ..., CFn)

\[
\text{CF}_j \quad \text{n}_j
\]

-147,000  n = 12
899.33   n = 12
1200.31  n = 12
1359.42  n = 12
1467.12  n = 12
1630.42  n = 11
1630.42 + 144,562 n = 1

Solve for the IRR:

\[
= 0.85\% \times 12 = 10.16\% \quad \text{(annual rate, compounded monthly)}
\]
Problem 5-7
Compute the payments, loan balances, and yield for an ARM that has a maximum 5% annual payment cap and does allow negative amortization.

Principal = $150,000
Term = 30 years
Points = 2.00%
Initial Rate = 7.0%

<table>
<thead>
<tr>
<th>Year</th>
<th>Balance</th>
<th>Uncapped Rate</th>
<th>Uncapped Payment</th>
<th>Capped Payment</th>
<th>EOY Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$150,000</td>
<td>7.00%</td>
<td>$997.95</td>
<td>$997.95</td>
<td>$148,476</td>
</tr>
<tr>
<td>2</td>
<td>$148,476</td>
<td>9.00%</td>
<td>$1,202.89</td>
<td>$1,047.85</td>
<td>$149,298</td>
</tr>
<tr>
<td>3</td>
<td>$149,298</td>
<td>10.50%</td>
<td>$1,380.27</td>
<td>$1,100.24</td>
<td>$151,894</td>
</tr>
<tr>
<td>4</td>
<td>$151,894</td>
<td>11.50%</td>
<td>$1,525.03</td>
<td>$1,155.26</td>
<td>$155,695</td>
</tr>
<tr>
<td>5</td>
<td>$155,695</td>
<td>13.00%</td>
<td>$1,747.28</td>
<td>$1,213.02</td>
<td>$161,731</td>
</tr>
<tr>
<td>6</td>
<td>$161,731</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: EOY Balance is calculated by using: \( FV(n, i, pv, pm) \)

PV = Loan amount
n = 12 months
i = Uncapped rate
PMT = Capped payment
FV =

Calculator: \( IRR(CF_1, CF_2, \ldots, CF_n) \)

\[
\begin{align*}
\text{CF}_j & \quad \text{n}_j \\
-147,000 & \quad 12 \\
997.95 & \quad 12 \\
1047.85 & \quad 12 \\
1100.24 & \quad 12 \\
1155.26 & \quad 12 \\
1213.02 & \quad 11 \\
1213.02 + 161,731 & \quad 1
\end{align*}
\]

Solve for the IRR:

\[
0.8706\% \times 12 = 10.45\% \text{ (annual rate, compounded monthly)}
\]
**Problem 5-8**

Compute the payments, loan balances, and yield for an ARM that has a 1% annual and 3% lifetime interest rate cap and does not accumulate negative amortization.

<table>
<thead>
<tr>
<th>Year</th>
<th>BOY Balance</th>
<th>Monthly Interest Rate</th>
<th>Capped Interest Rate</th>
<th>Uncapped Rate</th>
<th>Monthly Payment @ Capped Rate</th>
<th>Monthly Amort (5) - (6)</th>
<th>Annual Amort</th>
<th>EOY Balance (1) - (8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$150,000</td>
<td>7.50%</td>
<td>7.50%</td>
<td>0.63%</td>
<td>$1,048.82</td>
<td>$111.32</td>
<td>$1,382.75</td>
<td>$148,617</td>
</tr>
<tr>
<td>1</td>
<td>148,617</td>
<td>9.00%</td>
<td>8.50%</td>
<td>0.71%</td>
<td>$1,151.44</td>
<td>$98.74</td>
<td>$1,232.11</td>
<td>$147,385</td>
</tr>
<tr>
<td>2</td>
<td>147,385</td>
<td>10.50%</td>
<td>9.50%</td>
<td>0.79%</td>
<td>$1,255.55</td>
<td>$88.75</td>
<td>$1,112.59</td>
<td>$146,273</td>
</tr>
<tr>
<td>3</td>
<td>146,273</td>
<td>11.50%</td>
<td>10.50%</td>
<td>0.88%</td>
<td>$1,360.78</td>
<td>$80.89</td>
<td>$1,018.84</td>
<td>$145,254</td>
</tr>
<tr>
<td>4</td>
<td>145,254</td>
<td>13.00%</td>
<td>10.50%</td>
<td>0.88%</td>
<td>$1,360.78</td>
<td>$89.81</td>
<td>$1,131.12</td>
<td>$144,123</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BOY Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>144,123</td>
</tr>
</tbody>
</table>

Calculator: \( \text{IRR}(\text{CF}1, \text{CF}2, \ldots, \text{CF}n) \)

\[
\begin{align*}
\text{CF}_j & \quad n_j \\
-147,000 & \quad n = 12 \\
1,048.82 & \quad n = 12 \\
1,151.44 & \quad n = 12 \\
1,255.55 & \quad n = 12 \\
1,360.78 & \quad n = 12 \\
1,360.78 & \quad n = 11 \\
1,360.78 + 144,123 & \quad n = 1
\end{align*}
\]

Solve for the IRR:

\[
= 0.80\% \times 12 = 9.65\% \text{ (annual rate, compounded monthly)}
\]