

Sample 1:

```

C:\WINDOWS\system32\cmd.exe
Microsoft Windows [版本 10.0.17134.1069]
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C:\Users\HP>cd C:\Users\HP\source\repos\2\Debug

C:\Users\HP\source\repos\2\Debug>2 input1
Input File: input1
We owe 1790.85 in 10 years
Number of Cash Flows: 5

-----
Cash Flow #1
Price = 1131.27
Maturity = 10
Yield to Maturity = 0.0499999
Duration = 7.7587
Convexity = 70.4264
Percentage of Face Value that would meet the obligation = 0.892239
-----
Cash Flow #2
Price = 1069.88
Maturity = 15
Yield to Maturity = 0.0625639
Duration = 9.93582
Convexity = 119.831
Percentage of Face Value that would meet the obligation = 0.943436
-----
Cash Flow #3
Price = 863.5
Maturity = 30
Yield to Maturity = 0.07
Duration = 13.6774
Convexity = 262.769
Percentage of Face Value that would meet the obligation = 1.16892
-----
Cash Flow #4
Price = 1148.75
Maturity = 12
Yield to Maturity = 0.0574999
Duration = 8.58082
Convexity = 87.6798
-----
Cash Flow #5
Price = 1121.39
Maturity = 11
Yield to Maturity = 0.0549998
Duration = 8.20531
Convexity = 79.1966
Percentage of Face Value that would meet the obligation = 0.9001
-----
Model name:
Minimize      C1      C2      C3      C4      C5
R1             1             1             1             1             1 =      1
R2             7.7587  9.93582  13.6774  8.58082  8.20531 =     10
Type           Real      Real      Real      Real      Real
upbo           Inf      Inf      Inf      Inf      Inf
lowbo           0         0         0         0         0
Largest Convexity we can get is: 143.262
Optimal portfolio:
%Cash Flow:1  0.621321
%Cash Flow:2  0
%Cash Flow:3  0.378679
%Cash Flow:4  0
%Cash Flow:5  0
-----
To immunize against small changes in 'r' for each $1 of PV, you should buy
$0.621321 of Cash Flow#1
$0.378679 of Cash Flow#3
If you need to immunize for a larger PV-value, just buy an appropriate proportion
-----
For example, if you want to immunize for $500 of PV, buy
$310.661 of Cash Flow#1
$189.339 of Cash Flow#3
-----
For example, if you want to immunize for $750 of PV, buy
$465.991 of Cash Flow#1
$284.009 of Cash Flow#3
-----
For example, if you want to immunize for $1000 of PV, buy
$621.321 of Cash Flow#1
$378.679 of Cash Flow#3
-----
For example, if you want to immunize for $1009.36 of PV, buy
$627.137 of Cash Flow#1
$382.223 of Cash Flow#3
-----
C:\Users\HP\source\repos\2\Debug>_

```

Sample 2:

```
C:\WINDOWS\system32\cmd.exe
C:\Users\HP\source\repos\2\Debug>2 input2
Input File: input2
We owe 1790.85 in 10 years
Number of Cash Flows: 3

-----
Cash Flow #1
Price = 1131.27
Maturity = 10
Yield to Maturity = 0.0499999
Duration = 7.7587
Convexity = 70.4264
Percentage of Face Value that would meet the obligation = 0.934116
-----
Cash Flow #2
Price = 1121.39
Maturity = 11
Yield to Maturity = 0.0549998
Duration = 8.20531
Convexity = 79.1966
Percentage of Face Value that would meet the obligation = 0.942346
-----
Cash Flow #3
Price = 1148.75
Maturity = 12
Yield to Maturity = 0.0574999
Duration = 8.58082
Convexity = 87.6798
Percentage of Face Value that would meet the obligation = 0.919902
-----
Model name:
C1      C2      C3
Minimize -70.4264 -79.1966 -87.6798
R1        1        1        1 =        1
R2        7.7587  8.20531  8.58082 =       10
Type      Real      Real      Real
upbo      Inf      Inf      Inf
lowbo      0        0        0
There is no portfolio that meets the duration constraint of 10 years.
C:\Users\HP\source\repos\2\Debug>
```

Sample 3:

```
C:\WINDOWS\system32\cmd.exe
C:\Users\HP\source\repos\2\Debug>2 input3
Input File: input3
We owe 1790.85 in 10 years
Number of Cash Flows: 3

-----
Cash Flow #1
Price = 1051.52
Maturity = 10
Yield to Maturity = 0.0600001
Duration = 7.6655
Convexity = 67.9958
Percentage of Face Value that would meet the obligation = 0.951007
-----
Cash Flow #2
Price = 1095.96
Maturity = 15
Yield to Maturity = 0.0599997
Duration = 10
Convexity = 121.484
Percentage of Face Value that would meet the obligation = 0.912445
-----
Cash Flow #3
Price = 986.24
Maturity = 30
Yield to Maturity = 0.0599996
Duration = 14.6361
Convexity = 296.143
Percentage of Face Value that would meet the obligation = 1.01396
-----
```

```

Model name:
      C1      C2      C3
Minimize -67.9958 -121.484 -296.143
R1        1        1        1 =      1
R2        7.6655      10    14.6361 =     10
Type      Real      Real      Real
upbo      Inf      Inf      Inf
lowbo      0        0        0
Largest Convexity we can get is: 144.404
Optimal portfolio:
%Cash Flow:1  0.665093
%Cash Flow:2  0
%Cash Flow:3  0.334907
-----
To immunize against small changes in 'r' for each $1 of PV, you should buy
$0.665093 of Cash Flow#1
$0.334907 of Cash Flow#3
If you need to immunize for a larger PV-value, just buy an appropriate proportion
-----
For example, if you want to immunize for $500 of PV, buy
$332.546 of Cash Flow#1
$167.454 of Cash Flow#3
-----
For example, if you want to immunize for $750 of PV, buy
$498.82 of Cash Flow#1
$251.18 of Cash Flow#3
-----
For example, if you want to immunize for $1000 of PV, buy
$665.093 of Cash Flow#1
$334.907 of Cash Flow#3
-----
For example, if you want to immunize for $1009.36 of PV, buy
$671.318 of Cash Flow#1
$338.042 of Cash Flow#3
-----
C:\Users\HP\source\repos\2\Debug>_

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