

# Derivatives Lab

## Session 2

September 4, 2012

1. (From Ross, p. 45.) An individual who plans to retire in 20 years has decided to put an amount  $A$  in the bank at the beginning of each of the next 240 months, after which she will withdraw EUR 1000 at the beginning of each of the following 360 months. Assuming a nominal yearly interest rate of 6% compounded monthly, how large does  $A$  need to be?

2. Write a Python program which prints out an amortization schedule for a mortgage.

The program should take as input the nominal yearly interest rate  $r$ , the amount of the loan  $P$ , the number of compounding periods per annum  $m$ , and the term of the mortgage  $n$  in years. Assume that the mortgage is fully redeemed at the end of the term.

The program should compute the monthly payment, the effective annual interest rate, and a detailed payment schedule listing, for each month showing the interest and principal parts of the payment and the remaining principal.

Run your program on the following test case:  $P = 250\,000$ ,  $r = 0.08$ ,  $m = 12$ , and  $n = 15$ .

3. Find a closed form formula for the remaining principal right after the  $k$ th mortgage payment.
4. An investment sold at price  $P$  is guaranteeing a cash flow  $C_1, \dots, C_N$  at the end of each year. Write a program to compute its IRR (internal rate of return).

Run your program on the following test case:

```
N = 20
C = 100.0 * arange(3,N+3)
P = 20000.0
```