

# Stochastic Methods + Lab

## Session 2

September 6, 2016

*Note:* The work is to be submitted up to one week after the session via `git`. For this task sheet, it is sufficient to submit the code so long as it runs and produces the requested output.

1. An investment is guaranteeing a cash flow  $C_1, \dots, C_N$  at the end of each period. The period interest rate is  $y$ . Write python functions to compute the present value of the investment in three different ways:
  - (a) Using Numpy arrays;
  - (b) Using the `polyval` function;
  - (c) By writing an explicit Python loop.

Compare the run-time of the three implementations on the following test case:

```
C = 100.0 * arange(3,2003)
y = 0.05
```

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 with  $P = 250\,000$ ,  $r = 0.08$ ,  $m = 12$ , and  $n = 15$ .

3. 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
```