Johns Hopkins University
Department of Applied Mathematics & Statistics
Lecturer: Maxim Bichuch Fall 2015

EN 443
Financial Computing in C++
Assignment 6

due on Wed, Oct 21, 1:30pm

1. In this question you will need to write functions that will compute interest rates from given bond prices. Assume that today's date is Oct 7, 2015, and that all bonds pay semi-annual coupons, consider the following US Treasury bond prices from that date:

Name	Coupon (in %)	Maturity	Maturity (in years)	Price
1-months	0	11/05/15	0.0795	100.00
3-months	0	01/07/16	0.2521	100.00
6-months	0	04/07/16	0.5014	99.96
1-year	0	09/15/16	0.9425	99.77
2-year	0.625	09/30/17	1.9836	99.99
3-years	0.875	10/15/18	3.0247	99.85
5-years	1.375	09/30/20	4.9863	100.05
7-years	1.750	09/30/22	6.9863	100.02
10-years	2.00	08/15/25	9.8630	99.45
30-years	2.875	08/15/45	29.877	99.78

a) The prices of bonds quoted are usually clean prices that is they do not include the accrued interest (AI). AI is interest that has accumulated since the last coupon payment. When a bond is traded after the last coupon payment, the new holder of the bond will be the one who actually receives the coupon payment. To reimburse the bond seller for the interest he missed while holding the bond, in addition to the clean price of the bond, the bond purchases will pay the AI. AI can be computed as follows:

$$\text{AI} = \frac{\text{time since the last coupon payment}}{\text{time between the last and the next coupon}} \times \text{coupon},$$

where all times are in years, and assuming 365 days per year. For example, a coupon bond maturing on 12/01/2015 with 1% coupon will have

$$AI = \frac{128/365}{183/365} \times 0.5\% = 0.3497\%,$$

since 128 past since the last coupon (assume to be paid on 06/01/2015) and there are 183 days between coupons, and the coupon is semi-annual, so that the coupon payment is 0.5%. The clean price together with the AI is known as the dirty price.

In Excel, compute the dirty prices of the bonds in the above table.

b) Use these bond prices to build a yield curve. Specifically, for a given time $t > 0$ in years, compute the corresponding rate $R(t)$ as seen today(Oct 7), and for any two given times T and $T + \delta$, such that $T, \delta > 0$, compute the forward rate $f(0, T, T + \delta)$. To do this use the Natural Spline interpolation/extrapolation discussed in class.