

AMS-511 Foundations of Quantitative Finance

Fall 2020 — Assignment 02

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Question 1

Complete the following rate computations:

- Take the yield curve $\{y_1, y_3, y_5\}$ shown below and bootstrap the annual spot rates $\{s_1, s_2, \dots, s_5\}$. Use interpolation to estimate the missing yields you need to compute the spot curve.

```
mnYieldCurve = {  
    {1, 0.0249},  
    {3, 0.0273},  
    {5, 0.0281}  
}
```

- Using the spot rate curve, compute the short rates $\{r_1, r_2, \dots, r_5\}$.
- Compute the forward rate $f_{2,5}$.

Question 2

We are dealing with several projects whose benefits (*i.e.*, their PVs) are represented by a vector \mathbf{b} and costs by a vector \mathbf{c} . Given the total available capital k , we have the basic zero-one programming problem:

$$\max_{\mathbf{x}} \{ \mathbf{b}^T \mathbf{x} \mid \mathbf{c}^T \mathbf{x} \leq k, x_i \in \{0, 1\} \}$$

There are 10 separate projects, so $\mathbf{x} = \{x_1, x_2, \dots, x_9, x_{10}\}$.

However, you find that there are certain interdependencies that are not properly represented in the above integer linear program.

- Project 1 cannot be done, unless at least one of project 4 and project 7 are done.
- Project 2 cannot be done unless both project 5 and project 8 are done.
- Project 3 and project 9 cannot both be done, but neither or exactly one of them may be done.

Define the additional constraints necessary to achieve the conditions above.

Question 3

Use FinancialBond[] to compute the following:

- A newly issued \$10,000 bond with a ten-year term has a 4% coupon rate and pays semi-annually. The current market yield for a ten-year bond of this type is 3.7%. What is the current market price of the bond?
 - A \$10,000 bond with a five-year term, a 3.7% coupon rate paying semi-annually was issued eight months ago. The current market yield is 3.5%.
 - What is the current price of the bond?
 - What is the accrued interest on the bond?
 - Consider a \$10,000 semi-annual bond with a twenty-year term and a 4.5% coupon rate. The bond was issued five-years ago and currently trades at a price of \$10,500. What is the yield on the bond?
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Question 4

The TUV corporation has just paid a dividend and its next dividend is estimated to be \$1.4 million. It has a total market capitalization of \$35,000,000. The growth rate for this type of company is 10%. What is the implied discount rate for the dividends of this stock?