For the following problems, assume today is May 15, 2001.

* 1. Write down the cash flow dates and the cash flows of $1,000 face value of the U.S. Treasury 4s of April 30, 2003, issued on April 30, 2001.

|  |  |  |  |
| --- | --- | --- | --- |
| Date | Coupon payment | Principal payment | Cash flow |
| 10/30/2001 | 20 |  | 20 |
| 4/30/2002 | 20 |  | 20 |
| 10/30/2002 | 20 |  | 20 |
| 4/30/2003 | 20 | 1000 | 1020 |

* 1. Here is a list of bond transactions on May 15, 2001. For each transaction find out the transaction price.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bond | Price | Face Amount | Quote Price | Accrued Interest | Transaction Price |
| 10.75s of 5/15/2003 | 112-25/8 | $10000 | $11208.20313 | $0 | $11208.20313 |
| 4.25s of 11/15/2003 | 99-14+ | $1000 | $994.53125 | $0 | $994.53125 |
| 7.25s of 5/15/2004 | 107-4 | $1000000 | $1,071,250 | $0 | $1,071,250 |

* 1. Use this list of Treasury bond prices as of May 15, 2001, to derive the discount factors for cash flows to be received in 6 months, 1 year, and 1.5 years.

|  |  |  |  |
| --- | --- | --- | --- |
| Bond | Price | Quote Price | Discount Factors |
| 7.5’s of 11/15/2001 | 101-253/4 | 101.805 | 0.98125 |
| 7.5’s of 5/15/2002 | 103-1215/16 | 103.404 | 0.96120 |
| 11.625’s of 11/15/2002 | 110-211/4 | 110.664 | 0.93915 |

* 1. Suppose there exists a Treasury issue with a 7.5% coupon maturing on November 15, 2002. Using the discount factors derived in question 1.3, what would be the price of the 7.5s of November 15, 2002?

|  |  |  |  |
| --- | --- | --- | --- |
| Date | Cash flow of the bond | Discount Factors | Discounted Cash Flow |
| 11/15/2001 | 3.75 | 0.98125 | 3.67970 |
| 5/15/2002 | 3.75 | 0.96120 | 3.60445 |
| 11/15/2002 | 103.75 | 0.93915 | 97.43651 |
| Total |  |  | 104.7207 |

So the price should be $104.7207, or 104-231/16

* 1. [Continued from 1.4] Say that the 7.5s of November 15, 2002, existed and traded at a price of 105 instead of the price derived in question 1.4. How could one earn an arbitrage profit by trading the 7.5s of November 15, 2002, and the three bonds listed in question 1.3? Using the prices listed in question 1.3, how much arbitrage profit is available in this trade?

After calculation, we have:



From the table, we could see that the 7.5s of 11/15/2002 are rich at 105, the arbitrage trade is to sell the 7.5s of 11/15/2002 and buy the portfolio A.

Portfolio A is:

* Short 1.8108 of the 7.5s of 11/15/2001
* Short 1.8787 of the 7.5s of 5/15/2002
* Long 98.0508 of the 11.625s of 11/15/2002

Since the arbitrage price of the 7.5s of 11/15/2002 is 104.720765, the price of portfolio A is also 104.720765.

Then we can have arbitrage profit of $150 - $104.720765 = $0.279235 per $100 face amount of the 7.5s of 11/15/2002.