Task 1

1. Prepare a table of cash flows from bonds (the price of the bond is a negative flow, and the bond payment is positive) – handout.
2. Assume any level of the discount rate (in other words yield to maturity) and discount the cash flows.
3. Estimate the discount factor which we need to calculate the discounted cash flow.
4. To estimate the discount factor, use the following formula:

$$Discount\ factor = \frac{1}{\left(1+\frac{YTM}{m}\right)^{t}}$$

Task 1

5. Multiply each cash flow by the discount factor and calculate the discounted cash flows.
6. Sum up all discounted cash flows and calculate NPV.
7. If the NPV is equal to 0, the assumed discount rate is the yield to maturity.
8. If NPV is not equal to 0, repeat the calculation procedure and find the discount rate for which the NPV will be equal to 0 (if YTM is even number) or two discount rates that can be inserted into the formula (when YTM is not even number):

$$YTM = r_1 + \frac{NPV_1 \times (r_2 - r_1)}{NPV_1 + |NPV_2|}$$

Task 3

In the case of task 3, we can use the formula for calculating the price using ordinary annuity. However, this formula should be modified in some way:

$$NPV = I \times \left[\frac{1-\frac{1}{\left(1+\frac{r}{m}\right)^{n}}}{\frac{r}{m}}\right] + \frac{FV}{(1+\frac{r}{m})^{n}} - P$$

In this formula we need to calculate NPV so we need to subtract (take away) the price.

Task 7

1. Estimate cash flow for individual bonds.
2. Whenever the cash flow is negative multiply the price of bond by the number of this kind of bond. Then you will get the investment expenditure.
3. For all other positive cash flows calculate the flow (interest payment and in last period face value) and multiply them by number of bonds in the portfolio.
4. Sum up the cash flows for each period.
5. When this is ready follow the procedure from task 1.

Task 9

1. Assume the future value of interest for the first period (1-7 years). Use the formula on the future value of annuity:

$$\underline{A_n} = I \times \left[\frac{(1+r_{re})^n - 1}{r_{re}} \right]$$

2. Capitalize the interest for the overall investment period (15 years) using the formula:

$$R_n = A_n \times (1 + r_{re})^n$$

3. Repeat the procedure for each reinvestment interest period (8-10; 11-15) to get the value of future interest at the end of the investment period.

Task 9

4. Calculate the price of bond on the purchase date and on the end of the investment period using the formula:

$$P = I \times \left[\frac{1 - \frac{1}{\left(1+\frac{r}{m}\right)^n}}{\frac{r}{m}} \right] + \frac{FV}{(1+\frac{r}{m})^n}$$

5. Sum up the future values of interest and selling price of the bond to get total positive cash flows (FCF).
6. In the last stage, we use the formula:

$$RCY = \left(\frac{FCF}{P} \right)^{\frac{1}{n}} - 1$$