Problems Set n°1: Simple and Compound Interest and Discount

1. What is the future value of an investment of €200 for three months at a simple interest of 6.5%? Specify the interest earned. Solution: €203.25; €3.25

2. Knowing that the investment mentioned in the last problem was purchased from January 15 to March 5, 2005, focus the solution using a) exact simple interest and b) the Banker’s Rule. Solution:(48 days) €201.71; €201.73.

3. A note having a face value of €1300 and bearing interest at 7.5% will mature in 110 days. What is the maturity value?. Solution: €1329.8

4. a) Calculate the interest rate applied in a loan of €1000 with repayment of €1100 and duration of 10 months. b) What are the monthly interest, daily interest and fortnightly interest, equivalent to the yearly interest found in a)?. Solution: 12%; 1%; 0.033%; 0.5%

5. A man received a 30-day loan of €550 from the bank. The proceeds were €544.50. a) What was the discount rate applied? b) What are the monthly discount, daily discount and fortnightly discount, equivalent to the yearly discount found in a)?. Solution: 12%; 1%; 0.033%; 0.5%

6. Discount €1200 for 10 months at a rate of simple discount of 4.5%. What is its present value?. Solution: €1155

7. Discount €1200 for 10 months at an interest rate of 4.5%. What are its proceeds?. Solution: €1156.52

8. Taking the same present values for problems n°6 and n°7. What is the rate of discount and the interest rate, respectively, applicable to this aim? What are they said to be? Solution: i=4.65% equivalent to d=4.5%, and d=4.348% equivalent to i=4.5%

9. a) Repite the calculation of problems n°6 and n°7 with duration of 5 months. b) Find now the equivalent rates of interest and discount. Are they the same solutions found in n°8? c) If they are not, give a verbal interpretation of this change. Solution: i=4.5% equivalent to d=4.4%, and d=4.5% equivalent to i=4.58%

10. A man borrowed €800 from a bank that charges 5.5% interest in advance. He received €765 from the loan. When will the loan be due?. Solution: 9 months and 16 days.

11. Find the amount that must be invested at an effective rate of interest of 4% in order to accumulate €2000 at the end of three years. Solution: €1778

12. Calculate the amount received from a loan that charges interest in advance by 4% and must be repaid by €2000 at the end of three years. Solution: €1769.47

13. If the present value in problem n°12 is of €1778, what is the compound rate of interest in advance applied?. What are “z” and “i” said to be? Solution: i=0.4% is equivalent to z=3.846%.
14. a) Solve problem no 11 with duration of 1 year. b) With the present value obtained in a), find the rate of compound discount equivalent to \( i = 4\% \). c) Are they, \( z \) and \( i \), the same solutions found in problem no 13? In affirmative case, give a verbal interpretation of this fact. Solution: a) \( \text{€1923} \) b) \( z = 3.846\% \)

15. Given an interest of 12% “payable” semi-annually, find a) an effective half-yearly interest and b) a yearly, quarterly, monthly, and biennial interest, equivalent to a). Solution: a) 6%; b) 12.36%; 2.9563014%; 0.9758794%; 26.247696%

16. Given an effective interest of 12%, find a half-yearly interest equivalent to 12% per annum, and b) a nominal interest related to this semiannually interest found. How can it be named?. Solution: a) 5.8300524%; b) 11.6601049% “payable” semiannually, “convertible” semiannually, “compounded” semiannually, with reinvestment of interest each half-year.

17. When will a loan of \( \text{€3300} \) be discharged, assuming an effective interest of 6.5%, and repayment of \( \text{€3615} \)?. Solution: \( (1,447712234) \) 1 year, 5 months and 11 days.

18. When will a loan of \( \text{€3300} \) be discharged, assuming an effective interest in advance of 6.5%, and repayment of \( \text{€3615} \)?. Solution: \( (1,356511528) \) 1 year, 4 months and 8 days.

19. Bank A offers its depositors a monthly interest rate of 0.8%, while bank B gives its depositors an interest rate of 10% compounded semiannually. Which of the two banks makes the better offer? Solution: \( i^A = 10.03\% < i^B = 10.25\% \)

20. A man borrowed \( \text{€1000} \) and agreed to repay the money plus 8% interest in 6 months. Two months after the money was borrowed, the creditor agreed to settle the debt by discounting it at the same simple interest. a) How much did the creditor receive when he discounted the debt?. b) Discount the amount paid in a) at the date when the man initially borrowed the money and explain why it is different from the initial amount of \( \text{€1000} \). Solution: \( \text{€1012,987}; \text{€999,658} \).

21. Do again the last problem using a compound interest rate and explain why the amount discounted through the two ways are equals. Solution: \( \text{€1039,23}; \text{€1013} \)

Note 1. By omission of the formula to be applied:
- Short-duration FT, simple interest and discount. Discount “at an interest rate” means the use of simple interest. Discount “at a rate of discount”, use simple discount.
- Long-duration FT at an interest rate, compound interest. Discount at a rate of discount, compound discount.

Note 2. When referring to “interest in advance”, we will understand the use of discount formulas, either, simple or compound, depending on the duration of the FT.

Note 3. By omission in the time in interest/discount rates, all of them are annual.

Note 4. By omission in the type of compound interest/discount rates, except stated otherwise, all of them are “effective” rates, per annum or per periods. Look for words as “convertible”, “compounded”, “payable”, etc. to distinguish a nominal rate (always annual).