

1st Part: 35 Marks. All answers shall be given in the space available. All True/False questions have equal marking. During the test there won't be any comments or questions given. Write your name and number on every sheet. No mobile phones are allowed at any time.

Name: \_\_\_\_\_ Number: \_\_\_\_\_

In the following group of questions, every right answer has 2.5 marks each, wrong answers have -2.5 each (2.5 penalty mark). [Each group of questions will have a mark between 0 (minimum) and 10 (maximum)]  
 Write True (T) or False (F), with an X in the appropriate entry.

1. Consider Simple and Compound Interest calculation:

	T	F
In Compound Interest the effective semiannual interest rate is always proportional to the corresponding annual nominal rate compounded quarterly.	<input type="checkbox"/>	<input type="checkbox"/>
Annual discount factor $v$ is the same as the simple discount interest rate $d$ .	<input type="checkbox"/>	<input type="checkbox"/>
Money accumulated under simple or compound interest always lead to different values, no matter is the accumulation period, as long as the interest rate is positive.	<input type="checkbox"/>	<input type="checkbox"/>
In simple interest, the interest amount in each accumulation period is always constant (Principal and rate stay unchanged).	<input type="checkbox"/>	<input type="checkbox"/>

2. Consider Ordinary or Deferred annuities:

	T	F
The names <i>Annuity-Immediate</i> and <i>Annuity-Due</i> refer to the same.	<input type="checkbox"/>	<input type="checkbox"/>
A life insurance, with monthly paid premiums, is an <i>annuity-certain</i> .	<input type="checkbox"/>	<input type="checkbox"/>
$295.55({}_5 \ddot{a}_{\overline{2} 5\%}) = 295.55({}_4 a_{\overline{2} 5\%})$ .	<input type="checkbox"/>	<input type="checkbox"/>
$1/a_{\overline{2} 5\%} - 1/s_{\overline{2} 5\%} = 0.05$ .	<input type="checkbox"/>	<input type="checkbox"/>

In the next group of questions, tick  $\checkmark$  or write X in the box next to the answer you consider to be correct (only one is). In each group, a correct answer has 5 marks and a wrong answer gets -1.25 marks (penalty 1.25).

3. In compound interest, compute the nominal annual rate compounded semiannually equivalent to an effective quarterly rate of 2%:

- a) 8.08% ;    b) 4.00% ;    c) 8.00% ;    d) 4.04% .

4. Consider compound interest. Mr. Ed invested €50,000 for 5.5 years with an effective semiannual rate of 3%. The total interest produced in this application is:

- a) €8,826.73 ;    b) €19,211,69 ;    c) €18,889,38 ;    d) None of the previous .

5. Mr. Ed has to choose one of the following receipts:

- (i) Receive €10,000 in one year and the same amount in two years time, exactly;  
 (ii) Receive €10,250 within six months and the same amount within nine months.

Assuming a quarterly effective rate of 1% and compound interest, should Mr. Ed choose:

- a) (i) ;    b) (ii)     c) indifferent ;    d) Not enough information .

## Quantitative Finance Formulas

Interest accumulation:  $FV = PV + I$

Simple interest:  $FV = PV (1 + i \cdot t)$

Compound interest:  $FV = PV (1 + i)^t$

Simple discount:  $D = Fv \cdot d \cdot t$

I=Interest; P=Principal; i=interest rate

t=number of periods

Effective rates conversion:

$$i_L = (1 + i_S)^{1/S} - 1; i_S = (1 + i_L)^{S/L} - 1$$

Relation between nominal and effective rates:

$$i_A(m) = m[(1 + i_A)^{1/m} - 1]$$

Continuous compounding:

Nominal rate:  $\delta = \ln(1 + i_A)$

Future Value:  $S = Pe^{\delta t}$

Present Value:  $P = Se^{-\delta t}$

Present value of a n payment annuity immediate of

$$1 \text{ per period: } a_{\bar{n}|i} = \frac{1 - (1+i)^{-n}}{i}$$

Accumulated value of a n payment annuity immediate of 1 per period:

$$s_{\bar{n}|i} = \frac{(1+i)^n - 1}{i} = a_{\bar{n}|i}(1+i)^n$$

Present value of annuity due:

$$\ddot{a}_{\bar{n}|i} = 1 + a_{\overline{n-1}|i} = a_{\bar{n}|i}(1+i)$$

Accumulated value of annuity due:

$$\ddot{s}_{\bar{n}|i} = s_{\bar{n}|i}(1+i)$$

Present value of deferred annuity:

$${}_k|a_{\bar{n}|i} = a_{\bar{n}|i}(1+i)^{-k}$$

Accumulated value of deferred annuity:

$${}_k|s_{\bar{n}|i} = s_{\bar{n}|i}$$

Forborne annuities

$$FV = R \cdot S_{n|i}(1+i)^p$$

p- number of intervals between the last payment and FV.

Present value of perpetuity immediate:  $a_{\infty|i} = \frac{1}{i}$

Increasing arithmetic progression:

$$(C - h)a_{\bar{n}|i} + h(IA)_{\bar{n}|i}; \quad (IA)_{\bar{n}|i} = \frac{\ddot{a}_{\bar{n}|i} - n(1+i)^{-n}}{i}$$

Decreasing arithmetic progression:

$$(D - h)a_{\bar{n}|i} + h(DA)_{\bar{n}|i}; \quad (DA)_{\bar{n}|i} = \frac{n - a_{\bar{n}|i}}{i}$$

Geometric progression:  $C \frac{1 - r^n(1+i)^{-n}}{1+i-r}$

M<sup>thly</sup> payable annuity:

$$a_{\bar{n}|i}^{(m)} = a_{\bar{n}|i} \frac{i}{i^{(m)}}; \quad s_{\bar{n}|i}^{(m)} = s_{\bar{n}|i} \frac{i}{i^{(m)}}$$

Leasing:

Lease payment = PMT + I

PV = PMT  $a_{\bar{n}|i}$ , I = RV · i

Leasing (for an annuity immediate):

$$Vc = E + Ra_{\bar{n}|i} + RV(1+i)^{-n}, \text{ where}$$

Vc: value of the contract; E: entry value

RV = residual value; PMT = periodic payment

Linear Interpolation:

$$R_n = R_1 + [(R_2 - R_1) / (t_2 - t_1)] \cdot (t_n - t_1)$$

R<sub>n</sub> - unknown rate

R<sub>1</sub> and R<sub>2</sub> - two known

## 2<sup>nd</sup> Part (65 marks)

In this group write your calculations in the space below the question and write the final answer in the box provided. Do not forget to present all formulae and intermediate calculations needed.

### 1. (20 marks)

Mr. Ed borrowed a certain amount of money at a semiannual rate of 5%. He agreed to pay back the debt (money+interest) in the following terms:

€3,000.00 after 3 months, €5,000.00 after 9 months, and €10,000.00 Euros after 15 months.

Find the amount of money Mr. Ed borrowed considering simple interest.

R:

### 2. (20 marks)

Find the future value,  $S$ , of 20 semiannually payments of €3,000.00 each that Mr. Ed has to face, at  $i_s = 4\%$ , using compound interest.

R:

Name: \_\_\_\_\_ Number: \_\_\_\_\_

**3. (25 marks)**

Mr. Ed borrowed money to buy a new equipment. He will pay back that money in 4 years, through quarterly payments of €450 each. The nominal annual interest rate is 8,0% compounded quarterly. Find how much the equipment costs, if:

- a) The first payment is due three months after the loan;
- b) The first payment is due six months after the loan.

**a)**

R:

**b)**

R: