CONSUMER CREDIT

Task 1 – Purchase of a new TV set

We want to purchase a new TV set in the value of CZK 10,000.00. The bank lends us; its interest rate amounts to 11%. Let us suppose that we borrow for one year and we will pay the money at a time in the end of the year. In addition, let us suppose that the bank charges commission for granting of credit in the amount of CZK 400.00 and for administration and operation of the account CZK 200.00 a year. What is the rate of profit of the bank?

Solution:

```
First we should unassign all variables using the "restart" command. We
will appreciate this initial step in a case of the recalculation of this
document.
```

restart;

The amount of interest that we will pay to the bank

For calculation of the rate of profit we shall firstly determine the amount of interest that we will pay to the bank in the end of the year.
The interest will be determined by a simple calculation with percentage as follows: $u := 10000 \cdot 0.11 = 1100.00$ CZK.

The rate of profit

The rate of profit will be determined based on so-called annual percentage rate (in finance known under abbreviation APR). APR takes into account, in addition to interest rate, also the charges related to granting of credit (e.g. the charges for approval and granting of credit, the charges for administration and operation of the account). Thus it is percentage rate that expresses total annual average cost of respective credit.

The formula for calculation of APR is $Dl = \sum_{k=0}^{n} \frac{a_k}{(1+i)^{t_k}}$;

$$Dl = \sum_{k=0}^{n} \frac{a_k}{(1+i)^{t_k}} \qquad \textbf{(1)}$$

where Dl is the amount of loan, k is the instalment or charge number, n is the number of instalments, a_k is the amount of *k-th* instalment (the instalments also include all charges related to the loan), t_k is interval expressed in the number of years and in fractions of years from granting of loan till the days of

instalments or payment of charges, *i* is APR to be found.

In this case of the number of instalments $n = 1$ we get from the formula **(1)** simple equation

$$Dl = a_0 + \frac{a_1}{1+i} .$$

```
According the assignment we will assign values to the corresponding
variables.
There are two ways of invoking a command. If it is ended by a colon
(:) or semi-colon (;), simply press the <Enter> key.
If a command is not closed by a colon or semi-colon but is developed
into its value, follow the next instructions:
1) Put the mouse pointer on the command (expression) and push the
right button.
2) From the opened context menu select "Evaluate and Display Inline"
(Instead of doing it you can use <Ctrl>+<=> keys).
3) Then the sign "=" and a value appear behind the expression.
```

Amount of loan:	$Dl := 10000 :$ CZK
Duration of the service (years):	$n := 1 :$ year
Number of instalments per year:	$m := 1 :$
Amount of a pure instalment:	$a1 := 10000 :$ CZK
Charge for operation of the credit:	$f := 200 :$ CZK
Charge for approval of the credit:	$a_0 := 400 :$ CZK
Interest rate:	$u := 10000 \cdot 0.11 = 1100.00$ CZK
Total amount of the *k-th* instalment:	$a_1 := a1 + f + u = 11300.00$ CZK
	$t_k := k :$

In this case, for the foregoing values, we get from the expression **(1)** simple equation of the form (2):

$$Rov := Dl = \sum_{k=0}^{n} \frac{a_k}{(1+i)^{t_k}};$$

$$10000 = 400 + \frac{11300.00}{1+i} \qquad \textbf{(2)}$$

The solution to the equation **(2)** will result in rate of profit *i*:

$$mzi := solve(Rov, i);$$

$$0.1770833333 \qquad \textbf{(3)}$$

Then the annual percentage rate equals $100 \cdot mzi = 17{,}71$ %.

Závěr

If we take into account the charges related to credit, interest rate will increase from 11% to 17.7%. Thus the rate of profit of the bank is 17.7%.

Notes

1. The banks and credit companies are obliged to state APR of their consumer credits. This duty does not pertain to certain types of credits. The banks usually state APR indicator, however mostly in such a way that the clients do not notice it at first sight. In addition, it is necessary to take into account that in their rate scales the banks state the minimum rates. This means that it is very difficult to get the stated APR and in practice the client as a rule gets a higher rate.

2. Unlike the data such as annual interest rate or an increase, APR can also reflect cash flow in time - it is said that Czech crown today has a higher value than the Czech crown tomorrow as today's Czech crown can be invested so that it can immediately earn money.

The following example shows that it is important to follow APR and not interest rate or an increase.

Example – Purchase of washing drier

We want to purchase washing drier in the value of CZK 18 000.00. In order to gain necessary capital, we have the following possibilities at disposal:

a) Non-cash consumer credit with interest rate 12% p.a. and charge CZK 400.00 for evaluation of loan application (the charge is paid upon approval of the application), with charge CZK 250 p.a. for administration of credit account (to be paid in the end of the year) and with a single payoff in the end of the year.

b) Consumer credit with interest rate 12% p.a. and charge CZK 400 for evaluation of loan application (the charge is paid upon approval of the application), with charge CZK 250 p.a. for administration of credit account (to be paid in the end of the year) and with twelve instalments, each in the end of the month (taking into account monthly entering the interest accrued).

c) Instalment selling, so-called credit "1/10". This credit consists in the fact that we will pay 10% of the price for the goods in cash, subsequent ten instalments amount to 10% of the price for the goods.

Solution:

as to a)

Amount of loan: $Dl := 18000 : \text{CZK}$

Duration of the service (years):	$n := 1 :$ year
Number of instalments per year:	$m := 1 :$
Charge for operation of the credit:	$f := 250 :$ CZK
Charge for approval of the credit:	$a_0 := 400 :$ CZK
Interest rate:	$u := 12 :$ %
Total amount of the *k-th* instalment:	$a_1 := a_0 + Dl + f + \frac{Dl \cdot u}{100} = 20810$ CZK

If we suppose that we will pay the whole outstanding amount $Dl = 18000$ CZK in a year with interest, the purchase of washing drier will cost $a_1 := a_0 + Dl + f + \frac{Dl \cdot u}{100} = 20810$ CZK. We will pay extra amount CZK $a_1 - Dl = 2810$.

as to b)

Amount of loan:	$Dl := 18000 :$ CZK
Duration of the service (months):	$n := 12 :$ months
Charge for operation of the credit:	$f := 250 :$ CZK
Charge for approval of the credit:	$a_0 := 400 :$ CZK
Monthly interest rate:	$i := \frac{0.12}{12} :$
Discont factor:	$v := \frac{1}{1+i} :$

The amount of monthly instalment is calculated according to formula $a = \frac{Dl \cdot i}{(1 - v^n)}$, where i is monthly interest rate, n is the date of maturity in months, Dl is the amount of credit and v is discount factor. After setting of the following parameters in the formula we get the amount of monthly instalment:

$a1 := \frac{Dl \cdot i}{(1 - v^n)} = 1599{,}28$ CZK

In case of monthly instalments and monthly interest period we would pay for the washing drier the amount $a_1 := 12 \cdot a1 + a_0 + f = 19841{,}34$ CZK.
This means that we will pay extra amount CZK $a_1 - Dl = 1841{,}34$.

as to c)

For washing drier we will pay at the beginning 10% of CZK 18 000.00, i.e. CZK $18000 \cdot 0.1 = 1800.0$, and then for the period of 10 months we will pay off each month CZK 1800.00. We will

pay for the goods total amount CZK 19 800.00, i.e. extra amount CZK 1 800.00.

Comparison of the foregoing possibilities according the extra amount

If we are to decide based on the above calculations, we will definitely select instalment selling, so-called credit "1/10". For this credit, we will pay the lowest extra amount (CZK 1 800). We will pay the highest extra amount for single payoff (CZK 2 810).

Hereinafter we will show that this selected alternative is not automatically the best one. Seemingly the worst selection, when total cost of the washing drier amounts to CZK 20 810, requires payment of the amount of CZK 400 only at the beginning of the year. We pay off the remaining part CZK 20 410 only in the end of the year. During the year we can improve value of the money. For example, we have established building saving in which we achieve target amount only in a year and thus the instalment in the end of the year is convenient for us. We concluded the contract of building saving in the end of 2003, i.e. still under old conditions – 25% national assistance (the maximum amount CZK 4500 a year), interest running of the deposit 3% p.a., the minimum saving period 5 years.
Instead of investing the amount CZK 18 000 in the washing drier, we will deposit the amount at the beginning of the year to our building saving account. In the end of the year the interest accrued from CZK 18 000 in the amount of 3% is entered, i.e. CZK $18000 \cdot 0.03 = 540.00$, and in April of the following year we receive national assistance in the amount CZK $18000 \cdot 0.25 = 4500.00$. For the year we improved value of CZK 18 000 to $18000 + 540 + 4500 = 23040$. Total cost of the washing drier in a single payoff amounts to CZK 20 810. Due to the fact that we paid off a year later, we earned CZK $23040 - 20810 = 2230$.
We can see that the seemingly worst selection is in fact the best one. How is it possible? We did not take into account time factor that is considered by APR.

Hereinafter you can see APR calculation for each of the above alternatives

as to a) In case of payment of credit by means of single payoff in the end of the year and with charges CZK 400.00 for approval of credit and CZK 250.00 for operation of the account, the formula for APR is: $Dl = a_0 + \frac{a_1}{1+i}$, where a value of i corresponds to the APR.

	restart :
Amount of loan:	$Dl := 18000$: CZK
Charge for operation of the credit:	$f := 250$: CZK
Charge for approval of the credit:	$a_0 := 400$: CZK
Interest rate:	$u := 12$: %
Total amount of the instalment:	$a_1 := Dl + f + \frac{Dl \cdot u}{100} = 20410$ CZK

To get APS we solve the following equation in unknown i: $Resi := fsolve\left(Dl = a_0 + \frac{a_1}{1+i}, i\right)$;

0.1596590909 **(4)**

APR expressed in percentage amounts to $100 \cdot Resi = 15{,}97$ **%.**

ad b) If we pay off monthly instalments in the amount of CZK 1599 and the charges remain the same, APR results from solution of the equation: $Dl = a_0 + \sum_{k=1}^{11} \frac{a_k}{(1+i)^{\frac{k}{12}}} + \frac{a_{12}}{1+i}$

restart :

Amount of credit:	$Dl := 18000$: CZK
Charge for operation of the credit:	$f := 250$: CZK
Charge for approval of the credit:	$a_0 := 400$: CZK
Interest rate:	$u := 12$: %
Amount of k-th instament:	$a_k := 1599$: $k = 1..11$
Final payment:	$a_{12} := 1599 + f$:

APR results from solution of the equation with respect to i:

$$Resi := fsolve\left(Dl = a_0 + \sum_{k=1}^{11} \frac{a_k}{(1+i)^{\frac{k}{12}}} + \frac{a_{12}}{1+i}, i\right);$$

0.2020328719 **(5)**

APR expressed in percentage amounts to $100 \cdot Resi = 20{,}20$ **%.**

as to c) For credit "1/10" from credit company, APR is solution to the equation $Dl = \sum_{k=0}^{10} \frac{\frac{Dl}{10}}{(1+i)^{\frac{k}{12}}}$

restart :

Amount of credit:	$Dl := 18000$: CZK

APR results from solution of the equation with respect to i: $Resi := fsolve\left(Dl = \sum_{k=0}^{10} \frac{\frac{Dl}{10}}{(1+i)^{\frac{k}{12}}}, i\right);$

0.2627319130 **(7)**

APR expressed in percentage amounts to $100 \cdot Resi = 26{,}27$ **%.**

Conclusion
According to APR, the most advantageous alternative is a) taken by us, taking into account an increase, as the worst one. Alternative c) considered by us the best one, is according to APR the worst one.
Notes
Ordinary people mostly select the possibility of the smallest increase as they do not follow cash flow in time. In this way we can only proceed in case of decision-making between the alternatives whose all payments are in time coincidence.