COURSE 1
— MAP101 —
e-training

Myanmar Universities
UGA students - France

2018
Session 4

Exercise 1

Compound interest is the addition of interest to the principal sum of a loan or deposit, or in other words “interest on interest”. It is the result of reinvesting interest, rather than paying it out, so that interest in the next period is then earned on the principal sum plus previously accumulated interest. Compound interest is standard in finance and economics. From https://en.wikipedia.org/wiki/Compound_interest.

• Example 1 : assume a principal amount of 1000 euros is deposited in a bank paying an annual interest rate of 6% ($r = 0.06$). Then, denoting by $S_k$ the new amount after $k$ years, we successively have

\[
\begin{align*}
S_0 &= 1000 & \text{initial amount} \\
S_1 &= S_0 + 0.06 \times S_0 = S_0 \times (1 + 0.06) & \text{amount after 1 year} \\
S_2 &= S_1 + 0.06 \times S_1 = S_0 \times (1 + 0.06)^2 & \text{amount after 2 years} \\
S_3 &= S_2 + 0.06 \times S_2 = S_0 \times (1 + 0.06)^3 & \text{amount after 3 years} \\
S_4 &= S_3 + 0.06 \times S_3 = S_0 \times (1 + 0.06)^4 & \text{amount after 4 years} \\
& \vdots
\end{align*}
\]

I wrote the following two Scilab implementations of this process.

```scilab
// file S04exo1.sce
// EXAMPLE 1a
S = 1000; // initial amount
r = 0.06; // annual rate 6%
p = 8; // number of years
for i = 1 : p
    S = S * (1+r);
end
disp(S) // final amount // after p years
```

```scilab
// file S04exo1.sce
// EXAMPLE 1b
S = 1000; // initial amount
r = 0.06; // annual rate 6%
p = 8; // number of years
k = 1;
while k < p
    S = S * (1+r);
    k = k+1;
end
disp(S) // final amount // after p years
```

Result in the console :
--> 1593.8481

But, unfortunately, the two results are different, so that I certainly made a mistake in one of these two Scilab scripts (or both).

1. Can you fix this error (or these errors) ?

• Example 2 : assume now that the same principal amount of 1000 euros is deposited in a bank paying an annual interest rate of 6% ($r = 0.06$), compounded each three months
(n = 3). Denoting by $S_k$ the new amount after $k$ months, we successively have

\[
\begin{align*}
S_0 &= 1000 & \text{initial amount} \\
S_1 &= S_0 = 1000 & \text{no interest after 1 month} \\
S_2 &= S_0 = 1000 & \text{no interest after 2 months} \\
S_3 &= S_0 + 3 \times \frac{0.06}{12} \times S_0 = S_0 \left(1 + 3 \frac{0.06}{12}\right) & \text{cumulative interest for 3 months} \\
S_4 &= S_3 \\
S_5 &= S_3 \\
S_6 &= S_3 \left(1 + 3 \frac{0.06}{12}\right) = S_0 \times \left(1 + 3 \frac{0.06}{12}\right)^2 \\
\vdots
\end{align*}
\]

Consider the following two (uncompleted) Scilab implementations of this process.

// file S04exo1.sce
// EXAMPLE 2a
S = 1000; // initial amount
r = 0.06; // annual rate 6%
n = 3; // period of n months
p = 8; // 8 years
Nn = ...; // Number of months
for i = 1 : Nn
    if modulo(i, n) == 0 then
        S = ...;
    end
end
disp(S) // final amount

// file S04exo1.sce
// EXAMPLE 2b
S = 1000; // initial amount
r = 0.06; // annual rate 6%
n = 3; // period of n months
p = 8; // 8 years
Nn = ...; // Nn = Number of periods of n months during the p years
for i = 1 : Nn
    S = ...;
end
disp(S) // final amount

2. Please, complete these two scripts (precisely, complete the “…”)

3. Experiment this process for $n = 12$, $n = 6$, $n = 3$, $n = 1$.

4. And now, a very difficult question: with the same data, how many years are needed to get a final amount equal to 2000 when interests are compounded monthly?

For this question, complete the following script.

// file S04exo1.sce
// EXAMPLE 2c
S = 1000; // initial amount
r = 0.06; // annual rate 6%
n = 1; // period of 1 month
i = 0; // month number i = 0
while ...
    S = ...;
    i = i + 1
end
mprintf("%d months are needed = %.2f years", i, i/12)

2
Solution to exercise

1. The error was in the “while condition” of the second script: while k <= p

```plaintext
// file S04exo1.sce
// EXAMPLE 1a
S = 1000; // initial amount
r = 0.06; // annual rate 6%
p = 8; // number of years
for i = 1 : p
    S = S * (1+r);
end
disp(S) // final amount // after p years
```

```plaintext
// file S04exo1.sce
// EXAMPLE 1b
S = 1000; // initial amount
r = 0.06; // annual rate 6%
p = 8; // number of years
k = 1;
while k <= p
    S = S * (1+r);
    k = k+1;
end
disp(S) // final amount
```

2. 

```plaintext
// file S04exo1.sce
// EXAMPLE 2a
S = 1000; // initial amount
r = 0.06; // annual rate 6%
n = 3;
// period of n months
p = 8; // 8 years
Nm = 12*p; // Number of months
for i = 1 : Nm
    if modulo(i,n) == 0 then
        S = S * (1 + n*(r/12));
    end
end
disp(S) // final amount
```

```plaintext
// file S04exo1.sce
// EXAMPLE 2b
S = 1000; // initial amount
r = 0.06; // annual rate 6%
n = 3;
// period of n months
p = 8; // 8 years
Nn = (12 / n) * p; // Nn = Number of periods of n months during the p years
for i = 1 : Nn
    S = S * (1 + n*(r/12));
end
disp(S) // final amount
```

3. n = 12 : S = 1593.8481
   n = 6 : S = 1604.7064
   n = 3 : S = 1610.3243
   n = 1 : S = 1614.1427

4. 

```plaintext
// file S04exo1.sce
// EXAMPLE 2c
S = 1000; // initial amount
r = 0.06; // annual rate 6%
n = 1; // period of 1 month
i = 0; // month number i=0
while S < 2000
    S = S * (1 + r/12);
i = i + 1
end
mprintf("%d months are needed = %.2f years",i,i/12)
```

Result: 139 months are needed = 11.58 years
Exercise 2 *(with solutions in blue)*

1. In which region of France have these photos been taken? What is the name of this flower?

![Image 1](https://bespokeunit.com/)

2. What is this flower useful for?

*Lavender is used in the composition of many perfumes, but also for its therapeutic qualities (nervousness, digestive or joint problems) and its antiseptic and healing properties.*

3. What are Notes and the Fragrance pyramid in perfumery?

*Notes in perfumery are descriptors of scents that can be perceived upon the application of a perfume. Notes are separated into three classes: top/head notes, middle/heart notes, base notes, which denote groups of scents which are noticeable depending on the amount of time after the application of a perfume. These notes are created carefully with knowledge of the evaporation process and intended use of the perfume.*

*Top notes* are the most volatile part of fragrances. These are the scents appearing just after the vaporization of a perfume and whose evaporation begins after half an hour. *Heart notes* last for several hours and constitute the characteristic smell of a perfume. These are the ones that make all the personality of a perfume. *Base notes* of a perfume are those that take the longest to evaporate. Their main function is to fix the scent to make it last as long as possible.

4. The following fragrances all contain lavender. Most of them are for man, or for man and woman, but only one is for woman. Can you find this perfume dedicated to women?


5. Below are some famous perfumes and famous brands. Can you associate them?

<table>
<thead>
<tr>
<th>(A) Kenzo</th>
<th>(B) Yves Saint Laurent</th>
<th>(C) Lancôme</th>
<th>(D) Jean-Paul Gaultier</th>
<th>(E) Hermès</th>
</tr>
</thead>
<tbody>
<tr>
<td>(F) Givenchy</td>
<td>(G) Nina Ricci</td>
<td>(H) Guerlain</td>
<td>(I) Dior</td>
<td>(J) Chanel</td>
</tr>
</tbody>
</table>

![Perfumes](image)

Solution: `@WAYBPCCWDXEVFTGSHS@Q@@U@AR`

But unfortunately, this solution has been coded according to the Caesar code with a key equal to the date of birth in March of Zin Zar.

```// File S04exo2Perfumes.sce
// The solution :
solution = "1H2J3A4H5I6G7E8D9D10B11F12C"
// Coding :
key = 15 // birth day in March of Zin Zar
codedSolution = ascii( ascii(solution) + key )
// Coding :
decodedSolution = ascii( ascii(codedSolution) − key)
```

6. All these perfumes (above) are fragrances for women, except one for men. Which one?

*Le Mâle* (Jean-Paul Gaultier)
7. **Fragrance N°5** is probably (one of) the most famous and best-selling perfume in the world. Coco Chanel (1883-1971) was a French fashion designer and business woman.

7-a) What is the exact creation date of this perfume? And why precisely that day? Precisely, May 5, 1921 (5th day of the 5th month). Because every season, as a fashion designer, Coco Chanel always presented her new collection in May (and of course, she chose May 5). And also, because during the testing phase with the chemist Ernest Beaux, this fragrance that she selected was the 5th among a dozen others.

7-b) How many ingredients are needed to make this fragrance? (80 ingredients are required)

7-c) What is its main and crucial ingredient? What unique place does this ingredient come from? (The essential ingredient is jasmine from Grasse (South-East of France))

7-d) What inspired the simple shape of the bottle of this perfume? It was inspired by the shape of a bottle of whisky that her lost lover still had.

7-e) Where did Coco Chanel (essentially) live? She lived mainly at the Ritz Hotel, in Paris.

8. **La petite robe noire** (Guerlain) — https://www.youtube.com/watch?v=3rotn5D93vs

Why this name “La petite robe noire”? “A perfume is in its way an invisible dress, a game between what is hidden and what is revealed” — This beautiful oriental perfume was created in tribute to Coco Chanel. See also: https://www.youtube.com/watch?v=yqxKqfnfZ6g

9. **Shalimar** (Guerlain, 1921, 1925) — Why this name “Shalimar”? This fragrance was created in tribute to the young Indian princess, of Persian origin, Mumtaz Mahal, for whom Emperor Shah Jahan created the magnificent Shalimar Gardens and built the Taj Mahal.

10. Among perfumes, we can distinguish (in French) “Eau de cologne”, “Eau de toilette”, “Eau de parfum”, “Parfum”.

Can you explain the difference between these different names? It depends mainly on the concentration in aromatic compounds:

- Eau de cologne (4 to 6%),
- Eau de toilette (7 to 12%),
- Eau de parfum (intense) (12 to 20%),
- Parfum (20 to 40%).

11. What do we call a “nez” (a nose) in the French perfume industry? A “nez” is the nickname by which perfume creators are named. The perfume companies were historically located in Grasse (south France). Chanel, Guerlain, Patou, Hermes, Cartier all have their own “nez”.

12. Can you mention (at least) one way to extract the aromas of plants, flowers, ...? **Distillation** is a technical process (and indeed an art) used in perfumery and based on the ability of water vapor to capture essential oils.

**Enfleurage** is a method of making perfumes based on the use of a greasy substance and its ability to naturally absorb odors. One distinguishes between hot “enfleurage”,...
also known as maceration, and cold “enfleurage”, consisting in each case to obtain saturated fat in perfumes.

Extraction is a commonly used method for obtaining perfume. It consists of using a volatile solvent to dissolve the odorous material and then allow it to evaporate.

Infusion consists in extracting the aromas of a plant by dissolving them in an initially heated liquid (water, oil or alcohol), which is then allowed to cool for at least six months. Infusion proves to be a delicate and expensive technique and is very little used today.

Exercise 3

1. What is the strategy used by Gaston to find the secret number? Can you explain why Gaston is sure to find this secret number with just 7 questions.

2. Now, we come back to exercise 3 of session 3 (where we try to find a mysterious number). Complete the following Scilab script.

```scilab
// file S04exoGameMysteriousNumber.sce

// Title to start the game
mprintf("\t|-------------------------------------|
"
)mprintf("\t| THE GAME OF THE MYSTERIOUS NUMBER |
"
)mprintf("\t|-------------------------------------|
"
)

73

Hello Fantasio ! choose a secret number between 1 and 100 and I bet I can find it with just 7 questions

OK !

no

less than 50 ?

yes

less than 75 ?

no

less than 63 ?

no

less than 69 ?

no

less than 72 ?

no

less than 73 ?

yes

less than 74 ?

well done Gaston !!
// Mysterious number chosen randomly by Scilab (between 0 and N)
N = 100;
mysteriousNumber = int(N * rand(1, "uniform"));

ans = input("Are you ready to play (y/n)? ", "string")
if ans == "y" then
    mprintf("Nice, so we start ... \n")
    mprintf("you have to find a mysterious number between 0 and %d\n", N)
    n = 1;
    proposedNumber = input(" proposed number ? ")
    while proposedNumber ~= mysteriousNumber
        if proposedNumber > mysteriousNumber then
            mprintf("your number is too big, try again : ")
            proposedNumber = input(" proposed number ? ")
        else
            mprintf("your number is too small, try again : ")
            proposedNumber = input(" proposed number ? ")
        end
    end
    n = n + 1;
end
mprintf("Great ! you win after %d attempt(s)", n)
end

Solution to exercise 3

1. This is the bisection method.
   Gaston only needs 7 questions because $2^7 = 128 > 100$

2. // file S04exoGameMysteriousNumber.sce

// Title to start the game
mprintf("\t|-------------------------------------|\n")
mprintf("\t| THE GAME OF THE MYSTERIOUS NUMBER |\n")
mprintf("\t|-------------------------------------|\n")

// Mysterious number chosen randomly by Scilab (between 0 and N)
N = 100;
mysteriousNumber = int(N * rand(1, "uniform"));

ans = input("Are you ready to play (y/n)? ", "string")
if ans == "y" then
    mprintf("Nice, so we start ... \n")
    mprintf("you have to find a mysterious number between 0 and %d\n", N)
    n = 1;
    proposedNumber = input(" proposed number ? ")
    while proposedNumber ~= mysteriousNumber
        if proposedNumber > mysteriousNumber then
            mprintf("your number is too big, try again : ")
            proposedNumber = input(" proposed number ? ")
        else
            mprintf("your number is too small, try again : ")
            proposedNumber = input(" proposed number ? ")
        end
    end
    n = n + 1;
end
mprintf("Great ! you win after %d attempt(s)", n)
end