

UNIVERSITY OF CANBERRA
INTRODUCTION TO INFORMATION TECHNOLOGY (4478)

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Instructions

The sequence of assessments will test your knowledge and skills in writing an application software for a task, understanding the business rules of a particular problem, coding these in a computer program, developing a graphical user interface, and reading data from a text file from a disk. As such, the assignments will require you to integrate and synthesise what you will be learning each week in this unit, in order to design and create a proper working solution.

This second assignment builds up what you already completed in Assignment 1. That is, you will need to handle decision and control structures (if-while-for). Also, some inclusion of different data types will be needed (variables/constants, strings, integers and Booleans). Finally, following the Python Style Guide is required (attached in a different file). As usual, I have included the case study we started with on the previous week to assist you in this endeavour.

This second assessment requires you to:

- **Propose or pick the problem (shown below) that should be solved through coding.**
- **Follow the five-steps process to solve problems.**
- **Draw a flowchart describing the tasks included in the solving-problem process above.**
- **Write the corresponding pseudo code from the flowchart.**
- **Write the corresponding Python code.**
- **Your code should also include the following:**
 - A decision structure (IF-ELIF-ELSE).
 - Control structures (WHILE/FOR).
 - Use of strings, integers, floats and Booleans.
- **Coding using the Python style guide.**

If you can't think in a topic of your own, you may want to use this one:

Interest Rates

Savings accounts state an interest rate and a compounding period. If the amount deposited is P , the stated interest rate is r , and interest is compounded m times per year, then the balance in the account after one year is:

$$P \cdot \left(1 + \frac{r}{m}\right)^m$$

For instance, if \$1,000 is deposited at 3% interest compounded quarterly (that is, four times per year), then the balance after one year is:

$$1000 \cdot \left(1 + \frac{0.03}{4}\right)^4 = 1000 \cdot 1.0075^4 = \$1030.34$$

Interest rates with different compounding periods cannot be compared directly. The concept of APY (annual percentage yield) must be used to make the comparison. The APY for a stated interest rate r compounded m times per year is defined

The APY is the simple interest rate that yields the same amount of interest after one year as the compounded annual rate of interest.

Your module in Python language should compare interest rates offered by three different banks, determine the most favorable interest rate, and the balance in that account after one year.

I) Background: Five [5]marks for an improved background about the problem proposed or for the suitable background of your choosing topic.

Python can be very useful to create calculators, especially in finance where we can create programs to automate particular problems, instead of manually calculating 3 banks and finding their APY and balance. We can use a program/module so we do not have to manually calculate these problems and shorten the process for the user, after all inputs are entered into the module, the answer will be output.

The Module in Python language should compare interest rates offered by three different banks. Determine the most favorable interest rate and the balance in that account after one year. Create a calculator in python to do this for you, printing the solution.

II) Business Rules (based on the 5-steps solving - problems process) [Total marks:25]

1. Identify your inputs. [MARKS: 5 marks for a clear and specific description of updated inputs]

Input 1 = r (interest in decimal form (2dp)) = 0.04, 0.05, 0.03

Input 2 = m (compound interval in a year, in months) = 8, 4, 12

Input 3 = P (deposit (\$)) = \$2000

2. Identify the goal or objective (related to the output) [MARKS: 5 marks for a clear and specific description of updated outputs]

We need to assess the problem, and create a solution in the form of a calculator that outputs our balance and APY percentage.

We need to use the APY formula to compare the banks, and find the highest APY percentage between the 3 banks. Outputting the results. Different compounding periods cannot be compared directly that is why we must use APY. Following formula's to be implemented into calculator below.

$$APY = \left(1 + \frac{r}{m}\right)^m - 1$$

$$P \cdot \left(1 + \frac{r}{m}\right)^m$$

Details: (Bank - 1, P = \$2000, r = 0.04%, m = 8) (Bank - 2, P = \$2000, r = 0.05%, m = 4) (Bank - 3 P = \$2000, r = 0.03%, m = 12)

Compare banks, find the most favorable interest rate using the APY formula. Find the balance in that account after one year.

Your module in Python language should compare interest rates offered by three different banks, determine the most favorable interest rate, and the balance in the that account after one year.

3. Create a list of tasks to achieve your objective [MARKS: 5 marks for an updated sequence of tasks]

1. Create a flow chart, develop pseudocode from the flowchart, identify inputs and outputs, variables, constants decisions, loops, booleans, strings and integers etc.
2. Code the solution into Python IDLE, using the psuedocode as reference. Use your flowchart you as reference to write the solution into code.
3. Code inputs in **(r(1,2,3), m(1,2,3))**, floats for interest, interest and principal. Code in the lists, booleans, decision, while and for loops etc.
Output of the balance of the banks and the output of the best bank along with its APY%.
Print statement telling the user which is the best.

4. Develop a hand-written solution [MARKS: 5 marks for an updated written solution]

Using the interest, principle and compound interval. Solve the best balance and APY % between the 3 banks.

$$P \cdot \left(1 + \frac{r}{m}\right)^m$$

Commonwealth Bank = = \$2081.41

Beyond Bank =) = \$2101.89

St George Bank = = \$2060.83

$$APY = \left(1 + \frac{r}{m}\right)^m - 1$$

Commonwealth Bank (1) = 4% APY

Beyond Bank (2) = 5.1% APY

St George Bank (3) = 3% APY

Compare banks with the APY formula. Output the best bank option, balance and APY.

Solution: Bank 2 had the best APY, 5% interest, compounded quarterly. \$2000 dollars principal, \$2101.89 after one year.

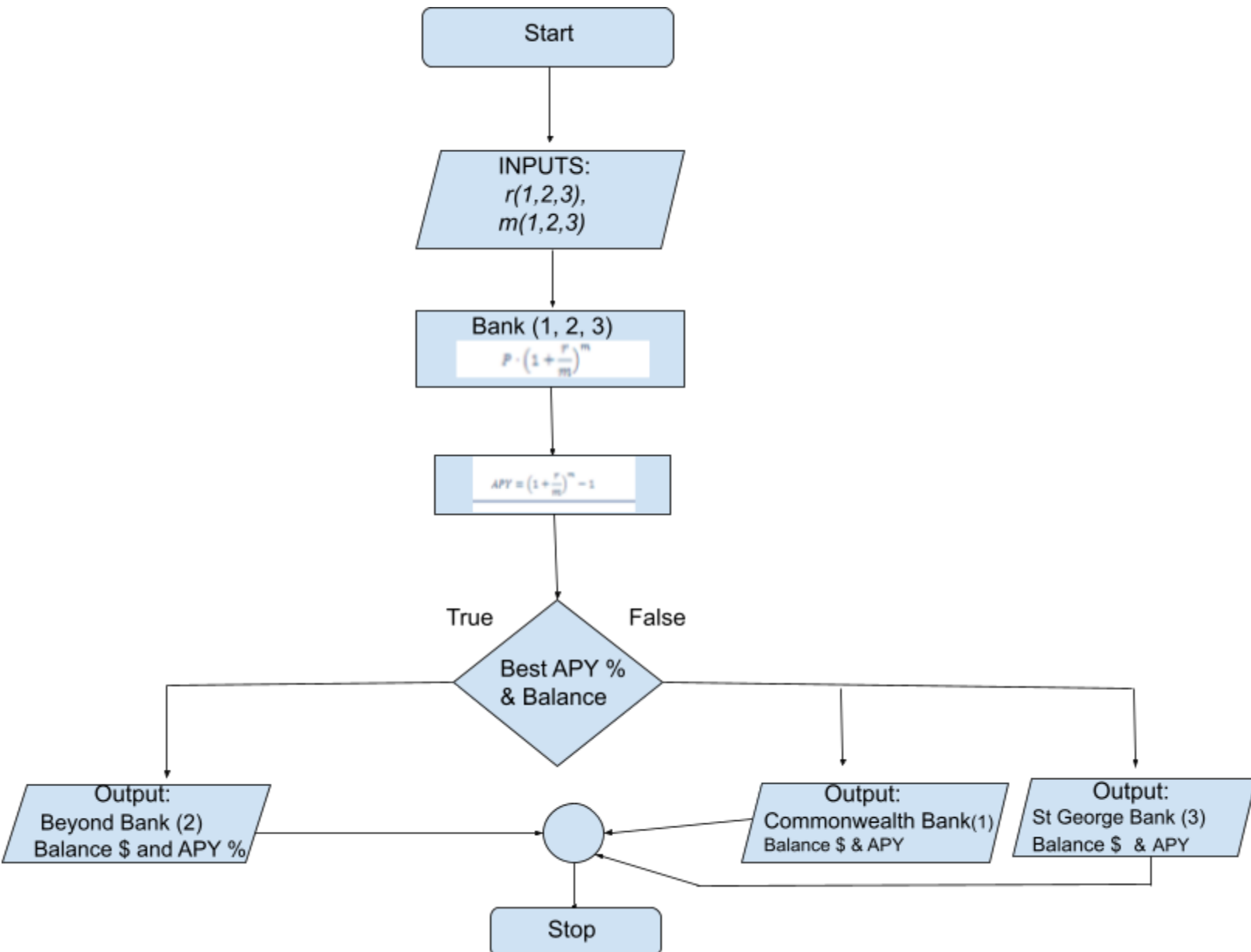
5. Assess (test) your solution [MARKS: 5 marks for properly assessing your solution]

1. Handwritten solution tested with a scientific calculator, handwritten results checked.
2. Use a Balance & APY calculator to test the results, tested and confirmed.
3. Inputs and output assessed and tested, correct.
4. Test our solution, in our own calculator and compare results. Results match the handwritten solution.
5. Tests conducted. Results match, python calculator works (TUI).

III) The process to Start Coding your Solution [Total marks: 70]

6. Produce a flowchart to describe the flow of instructions

[MARKS: 8 marks for a properly designed flowchart]



7. Derive pseudocode following step 6 [MARKS: 7 marks for a properly designed pseudocode]

```
## Date last changed:21/03/2022
## Author: Alex Greenfield
## Date created: 15/03/2022
## This program is an APY calculator, comparing 3 different banks.
## Input: r, m, P, Output: APY % & Balance
# APY% Calculator, Commonwealth Bank (1), Beyond Bank (2), St George(3)

#Bank1

SET Question1 TO INPUT("Is interest being compounded FOR more than 1 year?(True/False):")
IF Question1 EQUALS "True":
    SET boolean TO True
ELSEIF Question1 EQUALS "False":
    SET boolean TO False
ELSE:
    SET boolean TO "Error"
    OUTPUT("Please INPUT (True/False)?")

IF boolean EQUALS True:
    T=float(INPUT("How many years will the interest be compounded?-"))
    P=(float(INPUT("Insert Principal $-")))

    r1=(float(INPUT("Insert Commbank interest rate=")))
    m1=(float(INPUT("Insert Commbank Compound Interval=")))

#APY1 =  $(1+r1/m1)**m1-1$ 
#B1 =  $(p*(1+r1/m1)**m1)$ 

SET t TO 0
```

WHILE t<= T:

SET B1 TO $P*(1+r1/m1)m1$**

SET APY1 TO $(1+r1/m1)m1-1$**

SET t TO t+ 1

OUTPUT("year =", t)

OUTPUT("\$", B1)

OUTPUT("%", APY1)

break

#Bank2

SET Question2 TO INPUT("Is interest being compounded FOR more than 1 year?(True/False):")

IF Question2 EQUALS "True":

SET boolean TO True

ELSEIF Question2 EQUALS "False":

SET boolean TO False

ELSE:

SET boolean TO "Error"

OUTPUT("Please INPUT (True/False)?")

IF boolean EQUALS True:

T=float(INPUT("How many years will the interest be compounded?-"))

P=(float(INPUT("Insert Principal \$-")))

r2=(float(INPUT("Insert Beyond Bank interest rate=")))

m2=(float(INPUT("Insert Beyond Bank Compound Interval=")))

#APY2 = $(1+r2/m2)m2-1$**

#B2 = $(p*(1+r2/m2)m2)$**

SET t TO 0

WHILE t<= T:

SET B2 TO $P \cdot (1 + r/2/m)^{m \cdot 2}$

SET APY2 TO $(1 + r/2/m)^{m \cdot 2} - 1$

SET t TO t+ 1

OUTPUT("year =", t)

OUTPUT("\$", B2)

OUTPUT("%", APY2)

break

SET str TO 'Beyond Bank'

#Bank3

SET Question3 TO INPUT("Is interest being compounded FOR more than 1 year?(True/False):")

IF Question3 EQUALS "True":

SET boolean TO True

ELSEIF Question3 EQUALS "False":

SET boolean TO False

ELSE:

SET boolean TO "Error"

OUTPUT("Please INPUT (True/False)?")

IF boolean EQUALS True:

T=float(INPUT("How many years will the interest be compounded?-"))

P=(float(INPUT("Insert Principal \$-")))

r3=(float(INPUT("Insert St George interest rate=")))

m3=(float(INPUT("Insert St George Bank Compound Interval=")))

#APY3 = $(1 + r3/m3)^{m3} - 1$

#B3 = $(p \cdot (1+r3/m3)^{m3})$

SET t TO 0

WHILE t<= T:

SET B3 TO $P \cdot (1+r3/m3)^{m3}$

SET APY3 TO $(1+r3/m3)^{m3}-1$

SET t TO t+ 1

OUTPUT("year =", t)

OUTPUT("\$", B3)

OUTPUT("%", APY3)

break

SET list1 TO [APY1,APY2,APY3]

SET top_APY TO None

FOR num IN list1:

if(top_APY is None or num > top_APY):

SET top_APY TO num

OUTPUT("Highest APY%:", round(top_APY,6),"%")

SET list2 TO [B1,B2,B3]

SET best_bank TO None

FOR num IN list2:

if(best_bank is None or num> best_bank):

SET best_bank TO num

OUTPUT("Highest Balance Bank:", round(best_bank,2), "\$")


```
OUTPUT('Bank with the Highest APY & Balance:', str)
```

8. Code your solution using Python based on step 7 above.

[MARKS: 55marks for including below elements]

Python module code:

```
## Date last changed:21/03/2022
## Author: Alex Greenfield
## Date created: 15/03/2022
## This program is an APY calculator, comparing 3 different banks.
## Input: r, m, P, Output: APY % & Balance $
# APY% Calculator, Commonwealth Bank (1), Beyond Bank (2), St George(3)

#Bank1

Question1 = input("Is interest being compounded for 1 year?(True/False):")
if Question1 == "True":
    boolean = True
elif Question1 == "False":
    boolean = False
else:
    boolean = "Error"
    print("Please input (True/False)?")

if boolean == True:
    T=float(input("How many years will the interest be compounded?-"))
    P=(float(input("Insert Principal $-")))

    r1=(float(input("Insert Commbank interest rate=")))
    m1=(float(input("Insert Commbank Compound Interval=")))

#B1 =  $p \cdot (1+r1/m1)^{m1}$ 
#APY1 =  $(1+r1/m1)^{m1}-1$ 

t = 0

while t<= T:
    B1 =  $P \cdot (1+r1/m1)^{m1}$ 
    APY1 =  $(1+r1/m1)^{m1}-1$ 
    t = t+ 1
    print("year =", t)

    print("$", B1)
    print("%", APY1)
```

```
break
```

#Bank2

```
Question2 = input("Is interest being compounded for 1 year?(True/False):")
```

```
if Question2 == "True":
```

```
    boolean = True
```

```
elif Question2 == "False":
```

```
    boolean = False
```

```
else:
```

```
    boolean = "Error"
```

```
    print("Please input (True/False)?")
```

```
if boolean == True:
```

```
    T=float(input("How many years will the interest be compounded?-"))
```

```
    P=(float(input("Insert Principal $-")))
```

```
    r2=(float(input("Insert Beyond Bank interest rate=")))
```

```
    m2=(float(input("Insert Beyond Bank Compound Interval=")))
```

```
#B2 =  $p \cdot (1+r2/m2)^{m2}$ 
```

```
#APY2 =  $(1+r2/m2)^{m2}-1$ 
```

```
t = 0
```

```
while t<= T:
```

```
    B2 = P*(1+r2/m2)**m2
```

```
    APY2 = (1+r2/m2)**m2-1
```

```
    t = t+ 1
```

```
    print("year =", t)
```

```
    print("$", B2)
```

```
    print("%", APY2)
```

```
    break
```

```
str = 'Beyond Bank'
```

#Bank3

```
Question3 = input("Is interest being compounded for 1 year?(True/False):")
```

```
if Question3 == "True":
```

```
    boolean = True
```

```
elif Question3 == "False":
```

```
    boolean = False
```

```
else:
```

```
    boolean = "Error"
```

```
    print("Please input (True/False)?")
```

```
if boolean == True:
```

```
    T=float(input("How many years will the interest be compounded?-"))
```

```
    P=(float(input("Insert Principal $-")))
```

```

r3=(float(input("Insert St George interest rate=")))
m3=(float(input("Insert St George Bank Compound Interval=")))

#B3 =  $p \cdot (1+r3/m3)^{m3}$ 
#APY3 =  $(1+r3/m3)^{m3}-1$ 

t = 0

while t<= T:
    B3 =  $P \cdot (1+r3/m3)^{m3}$ 
    APY3 =  $(1+r3/m3)^{m3}-1$ 
    t = t+ 1
    print("year =", t)

    print("$", B3)
    print("%", APY3)
    break

list1 = [APY1,APY2,APY3]

top_APY = None

for num in list1:
    if(top_APY is None or num > top_APY):
        top_APY = num
print("Highest APY% in decimal form:", round(top_APY,6), "")

list2 = [B1,B2,B3]

best_bank = None

for num in list2:
    if(best_bank is None or num> best_bank):
        best_bank = num
print("Highest Balance:", round(best_bank,2), "$")

print('Bank with the Highest APY & Balance:', str)

```

Proof that the module works. Same solution that we came to when doing our testing, and doing our Handwritten calculations. We can confirm that the coded module is the solution and outputs the correct bank, highest balance and APY%.

```
Is interest being compounded for 1 year?(True/False):True
How many years will the interest be compounded?-1
Insert Principal $-2000
Insert Commbank interest rate=0.04
Insert Commbank Compound Interval=8
year = 1
$ 2081.4140878508747
% 0.040707043925437336
Is interest being compounded for 1 year?(True/False):True
How many years will the interest be compounded?-1
Insert Principal $-2000
Insert Beyond Bank interest rate=0.05
Insert Beyond Bank Compound Interval=4
year = 1
$ 2101.8906738281244
% 0.05094533691406222
Is interest being compounded for 1 year?(True/False):True
How many years will the interest be compounded?-1
Insert Principal $-2000
Insert St George interest rate=0.03
Insert St George Bank Compound Interval=12
year = 1
$ 2060.8319138270135
% 0.030415956913506736
Highest APY% in decimal form: 0.050945
Highest Balance: 2101.89 $
Bank with the Highest APY & Balance: Beyond Bank
```