

Alorithms4

Bank Owner

Review

- We can use Key Words
 - Display
 - Read
 - For() → EndFor
 - While() → EndWhile
 - If → EndIf
 - If Else → EndIfElse
- We can use variables
 - We come up with meaningful variable names and put them in <>

What is Variable?

- Something that is likely to vary, something that is subject to variation;
- It represents a place where a quantity can be stored.
- Variables are often contrasted with constants, which are known and unchanging.
- Think of it as a container
- It stores number and other data
- We can use variables
 - We come up with meaningful variable names
put them in < >



Bank Problem (Part A)

- Bank Owner needs a program that will sum up the accounts that his bank manages.
- Bank Owner wants the program that
 - will let him enter balance of each account
 - Print a statement that will show how much money his bank is managing.
 - For example as of now the bank has 5 accounts

Initial Approach

```
Display "Please enter amount for the first account"
Read< accountBalance1>
Display "Please enter amount for the second account"
Read< accountBalance2>
Display "Please enter amount for the third account"
Read< accountBalance3>
Display "Please enter amount for the forth account"
Read< accountBalance4>
Display "Please enter amount for the fifth account"
Read< accountBalance5>
<Sum>=0
<Sum>= <accountBalance1>+ <accountBalance2>+ <
  accountBalance3>+ < accountBalance4>+ <
  accountBalance5>
Display "You are managing ", <Sum>, " dollars"
```

What will the Banker see when he runs the program????

```
Please enter amount for the first account  130
Please enter amount for the second account  200
Please enter amount for the third account   350
Please enter amount for the forth account   1000
Please enter amount for the fifth account   20
You are managing 1700 dollars
```

Bank Complicates the Problem

- He got new accounts and he needs to be part of the report
 - He got 2 new accounts
- What do you do?
 - You have to change the code!
 - You need to add more **Displays**
 - You need to add more **Reads** and use more variables
 - You need to modify your **sum** statement and make it add the new accounts

```
Display "Please enter amount for the first account"
Read <accountBalance1>
Display "Please enter amount for the second account"
Read <accountBalance2>
Display "Please enter amount for the third account"
Read <accountBalance3>
Display "Please enter amount for the fourth account"
Read <accountBalance4>
Display "Please enter amount for the fifth account"
Read <accountBalance5>
Display "Please enter amount for the sixth account"
Read <accountBalance6>
Display "Please enter amount for the seventh account"
Read <accountBalance7>
<Sum>=0
<Sum>= <accountBalance1>+<accountBalance2>+
      <accountBalance3>+<accountBalance4>+
      <accountBalance5>+<accountBalance6>+<accountBalance7>
Display "You are managing "+ <Sum> " dollars"
```

Too much work

- It was simple when we knew we had only 5 accounts but now
 - it is getting VERY long
 - it has to change each time the banker has a change
 - If he has more accounts you have to add code
 - If he loses the accounts you have to remove code
 - It is very not flexible

There has to be a better way!!!!

Observations

- The program is very repetitive
 - we do the same thing over and over and over
 - Display, Read, Display Read, Display Read....
 - We add and add and add
- What if there was a loop that did the repetitive work
 - So why don't we make the program ask to repeat Display, Read, Add...

For now let it repeat it 7 times

```
Display "Please enter amount for the first account"  
Read <accountBalance1>  
Display "Please enter amount for the second account"  
Read <accountBalance2>  
Display "Please enter amount for the third account"  
Read <accountBalance3>  
Display "Please enter amount for the fourth account"  
Read <accountBalance4>  
Display "Please enter amount for the fifth account"  
Read <accountBalance5>  
Display "Please enter amount for the sixth account"  
Read <accountBalance6>  
Display "Please enter amount for the seventh account"  
Read <accountBalance7>  
<Sum>=0  
<Sum>= <accountBalance1>+<accountBalance2>+  
    <accountBalance3>+<accountBalance4>+  
<accountBalance5>+<accountBalance6>+<accountBalance7>  
Display "You are managing " + <Sum> " dollars"
```

Looping

The following code needs to be repeated

```
Display "Please enter amount for the first account"  
Read <accountBalance1>
```


We need to generalize the message so that the user does not notice that we are looping.

```
Display "Please enter amount for the account"  
Read <accountBalance>
```

Now let's write a loop that will run 7 times

First attempt

For (1 to 7)



```
For ( <i>=1, <i> < 8, <i>=<i>+1)
    Display "Please enter amount for the account"
    Read <accountBalance>
End For
```

Hmmm will this work?

Yes and No

it will ask for the amount 7 times but
<accountBalance> will change each time a user enters the amount. Thus we will lose the values that the user is entering.

What do we do?

What do we do?

- Currently our summation is out of the loop
- We need to bring the summation into the loop!
- How do we do that?
- Let's start with line
 <Sum>=0
- put it out of the loop
- Now what?
 - Currently we collect all the amounts and add them later at the end.

What do we do?

- What if we add as soon as user gives us the amount
 - So we start with `<Sum> = 0`
 - Use tells us that the first amount is 100
 - So we update the `<Sum> = 100`
 - User enters next amount 200
 - So we update the `<Sum> = 300`
 -
- **This is so repetitive!** → need to put it into LOOP

How about this code?

```
For (<i>=1, <i> < 8, <i>=<i>+1)
  <Sum>=0
  Display "Please enter amount for the account"
  Read <accountBalance>
  <Sum> = <Sum>+ <accountBalance>
End For
```

- Looks better but here is a problem!!! Every time we run the loop the sum is reset to 0.

This will not do what we want!!!

Correction

<Sum>=0

For (<i>=1, <i> < 8, <i>=<i>+1)

Display "Please enter amount for the account"

Read <accountBalance>

<Sum> = <Sum>+ <accountBalance>

End For

- How about now?
- **Looks good !** We just need to print out the final result of our summation.

Secondary Approach

<Sum>=0

For (<i>=1, <i> < 8, <i>=<i>+1)

Display "Please enter amount for the account"

Read <accountBalance>

<Sum> = <Sum>+ <accountBalance>

End For

Display "You are managing ", <Sum>, " dollars"

How many variables are we using in the **Secondary Approach**?

<Sum>, <accountBalance>

How many variables were we using in the **Initial Approach**?

<Sum>, <accountBalance1>, <accountBalance2>,
<accountBalance3>, <accountBalance4>, <accountBalance5>,
<accountBalance6>, <accountBalance7>

```

Display "Please enter amount for the first account"
Read <accountBalance1>
Display "Please enter amount for the second account"
Read <accountBalance2>
Display "Please enter amount for the third account"
Read <accountBalance3>
Display "Please enter amount for the fourth account"
Read <accountBalance4>
Display "Please enter amount for the fifth account"
Read <accountBalance5>
Display "Please enter amount for the sixth account"
Read <accountBalance6>
Display "Please enter amount for the seventh account"
Read <accountBalance7>
<Sum>=0
<Sum>= <accountBalance1>+<accountBalance2>+
      <accountBalance3>+<accountBalance4>+
      <accountBalance5>+<accountBalance6>+<accountBalance7>
Display "You are managing " + <Sum> " dollars"

```

Bank Owner throws a Ranch in to the design!

- He keeps having changes!
- Now he has more accounts.
- You have to rewrite the code again
- small change but still work on your side

```

<Sum>=0
For (<i>=1, <i> < 8, <i>=<i>+1)
    Display "Please enter amount for the account"
    Read <accountBalance>
    <Sum> = <Sum>+ <accountBalance>
End For
Display "You are managing ", <Sum>, " dollars"

```



Bank Owner throws a Wrench in to the design!

- He also wants us to print

Please enter amount for the account #1

Please enter amount for the account #2

....

```
<Sum>=0
For (<i>=1, <i> < 8, <i>=<i>+1)
    Display "Please enter amount for the account"
    Read <accountBalance>
    <Sum> = <Sum>+ <accountBalance>
End For
Display "You are managing ", <Sum>, " dollars"
```



Lets look at the first correction

- How can we make our program work for any number of accounts?
- What if we ask a user to first tell the program how many accounts will be summed up?

We can do that through Display Read

```
Display "How many accounts would you like to sum up?"
Read<NumberOfAccounts>
```

Each time the Banker runs our the program he has to put in the number.
So number accounts goes up to 15 the banker will enter 15

First correction

```
Display "How many accounts would you like to sum up?"
Read <NumberOfAccounts>
<Sum>=0
For (<i>=1, <i> =< <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account"
    Read <accountBalance>
    <Sum> = <Sum>+ <accountBalance>
End For
Display "You are managing ", <Sum>, " dollars"
```

Second Correction

```
Display "How many accounts would you like to sum up?"
Read <NumberOfAccounts>
<Sum>=0
For (<i>=1, <i> =< <NumberOfAccounts>, <j>=<j>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <Sum> = <Sum>+ <accountBalance>
End For
Display "You are managing ", <Sum>, " dollars"
```

Banker wants a new extension

- The Banker wants to separate accounts into checking and savings
- He wants
 - Program to ask
 - “Please enter amount for the checking account#”,
 - “Please enter amount for the savings account#”
 - Single report that tells him
 - “Bank manages \$\$\$ in checking accounts”
 - “Bank manages \$\$\$ in savings accounts”
- Banker tells us that is possible that number of checking and savings accounts could be different

What do we do?

- We have to ask user 2 questions (about savings and checking)
 - Maybe different number of times
 - We need 2 separate loops
- OK lets give it try

```

Display "How many checking accounts would you like to sum up?"
Read <NumberOfAccounts>
<Sum>=0
For (<i>=1, <i> =< <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <Sum> = <Sum>+ <accountBalance>
End For
Display "Bank manages" <Sum>," in checking accounts"

Display "How many savings accounts would you like to sum up?"
Read <NumberOfAccounts>
<Sum>=0
For (<i>=1, <i> =< <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <Sum> = <Sum>+ <accountBalance>
End For
Display "Bank manages" <Sum>," in savings accounts"

```

Will this work? YES

Banker comes back AGAIN

- He wants the program to do 2 more things
 - He does not like the fact that reports are separated
 - Program asks for balance of checking and then give a sum
 - And then asks for balance of checking and then give a sum
 - He wants to enter all of the balances and then get the report
- We have to change the code to do what he asks!

```

Display "How many checking accounts would you like to sum up?"
Read <NumberOfAccounts>
<Sum>=0
For (<i>=1, <i> =< <NumberOfAccounts>, <j>=<j>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <Sum> = <Sum>+ <accountBalance>
End For

Display "How many savings accounts would you like to sum up?"
Read <NumberOfAccounts>
<Sum>=0
For (<i>=1, <i> =< <NumberOfAccounts>, <j>=<j>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <Sum> = <Sum>+ <accountBalance>
End For

Display "Bank manages" <Sum>," in Checking accounts"
Display "Bank manages" <Sum>," in Savings accounts"

```

Will this work? **NO**

What is the Problem

- <Sum> is Lost and that is a problem!!!
- How do we fix our problem?
- We need 2 sums that are named differently! This way they will not clash!

```

Display "How many checking accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumChecking> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <SumChecking> = <SumChecking> + <accountBalance>
End For

Display "How many savings accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumSavings> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <SumSavings> = <SumSavings> + <accountBalance>
End For

Display "Bank manages", <SumChecking>, " in Checking accounts"
Display "Bank manages", <SumSavings>, "in Savings accounts"

```

Will this work? YES

Banker is Back

- He wants a line to be added that will give him the total of the amount that he manage.


```

Display "How many checking accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumChecking> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <SumChecking> = <SumChecking> + <accountBalance>
End For
Display "How many savings accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumSavings> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <SumSavings> = <SumSavings> + <accountBalance>
End For

<TotalAmnt> = <SumChecking> + <SumSavings>

Display "Bank manages", <SumChecking>, " in Checking accounts"
Display "Bank manages", <SumSavings>, "in Savings accounts"
Display "Total amount managed is Bank manages", <TotalAmnt>

```

Will this work? YES

Banker is Back yet Again

- Now he wants the program to print he largest amount first and the smallest amount second
 - If checking amount is grater then savings then he wants to see checking first and savings second
- How do solve this?
- This is a conditional statement
- We need to use **IF Else**

```

Display "How many checking accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumChecking> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <SumChecking> = <SumChecking> + <accountBalance>
End For
Display "How many savings accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumSavings> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    <SumSavings> = <SumSavings> + <accountBalance>
End For
<TotalAmnt> = <SumChecking> + <SumSavings>
If ( <SumChecking> > <SumSavings> )
    Display "Bank manages", <SumChecking>, " in Checking accounts"
    Display "Bank manages", <SumSavings>, "in Savings accounts"
Else
    Display "Bank manages", <SumSavings>, "in Savings accounts"
    Display "Bank manages", <SumChecking>, " in Checking accounts"
EndIf Else
Display "Total amount managed is Bank manages", <TotalAmnt>

```

Will this work? YES

Banker is back and he wants more

- Now he wants the program to print a Warning
- If the amount of the account is larger than 100,000 that it is not insured by FDIC.

```

Display "How many checking accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumChecking> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    If (<accountBalance>> 100,000)
        Display "This balance cannot be ensured"
    EndIf
    <SumChecking> = <SumChecking> + <accountBalance>
End For
Display "How many savings accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumSavings> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    If (<accountBalance>> 100,000)
        Display "This balance cannot be ensured"
    EndIf
    <SumSavings> = <SumSavings> + <accountBalance>
End For
<TotalAmnt> = <SumChecking> + <SumSavings>
If ( <SumChecking> > <SumSavings> )
    Display "Bank manages", <SumChecking>, " in Checking accounts"
    Display "Bank manages", <SumSavings>, "in Savings accounts"

```

```

Display "How many checking accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumChecking> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    If (<accountBalance> > 100,000)
        Display "This balance cannot be ensured"
    EndIf
    <SumChecking> = <SumChecking> + <accountBalance>
End For
Display "How many savings accounts would you like to sum up?"
Read <NumberOfAccounts>
<SumSavings> =0
For (<i>=1, <i> < <NumberOfAccounts>, <i>=<i>+1)
    Display "Please enter amount for the account#", <i>
    Read <accountBalance>
    If (<accountBalance> > 100,000)
        Display "This balance cannot be ensured"
    EndIf
    <SumSavings> = <SumSavings> + <accountBalance>
End For
<TotalAmnt> = <SumChecking> + <SumSavings>
If ( <SumChecking> > <SumSavings> )
    Display "Bank manages", <SumChecking>, " in Checking accounts"
    Display "Bank manages", <SumSavings>, "in Savings accounts"
Else
    Display "Bank manages", <SumSavings>, "in Savings accounts"
    Display "Bank manages", <SumChecking>, " in Checking accounts"
EndIf Else
Display "Total amount managed is Bank manages", <TotalAmnt>

```