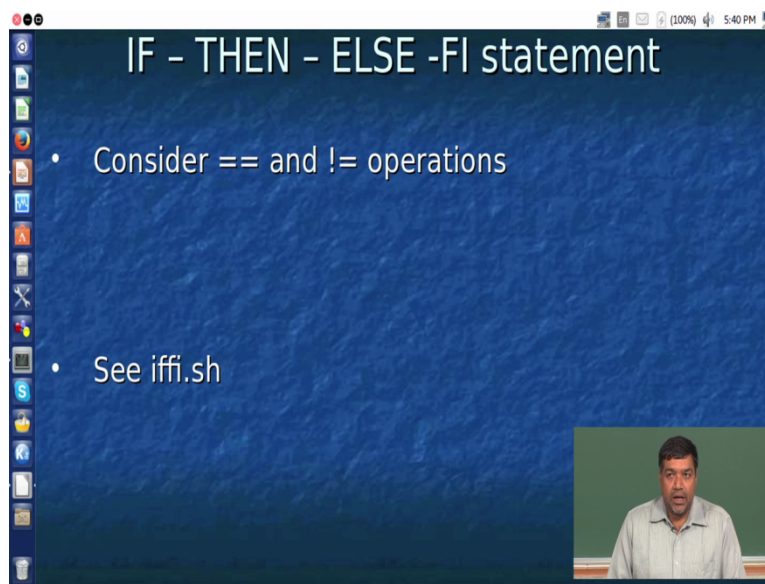


**Information Security**  
**Shell Condition and Relation**  
**Sri M J Shankar Raman,**  
**Consultant of Computer Science and Engineering**  
**Indian Institute of Technology Madras**  
**Module 31**  
**Relational Operators**

Hi there welcome to this session on relation operators and if statement. We have seen in the last session about arithmetic operations, so before we proceed to relational operations we will take a brief look at the if statement.

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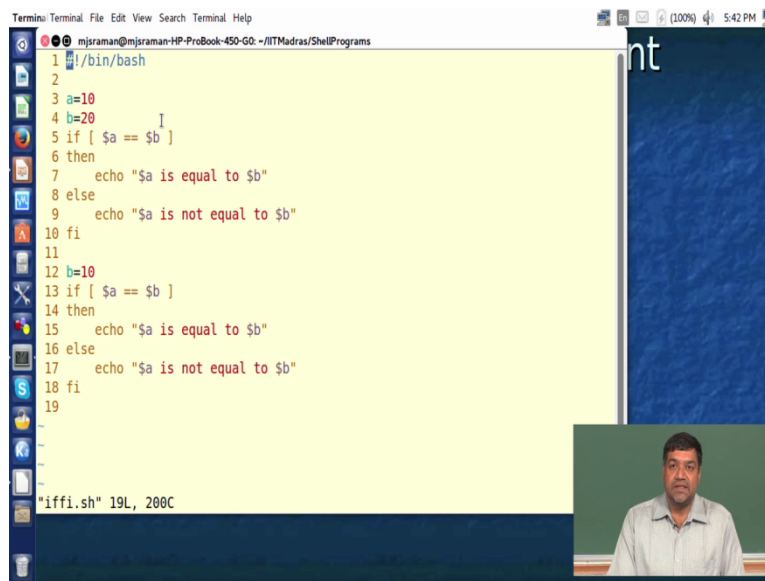


So why do we need if statements, at many points in your Shell scripting when I want to do a bunch of operations I may have how to take a decision so I've to take a decision on whether to go in one path or in another path.

This is a part of structured programming and in this kind of structured programming where structure design I will always come to your note that I've to make a choice between whether I should take a decision based on a certain condition.

So this if then else and FI together helps you move from one path to another Path, usually the conditions or will be either equal to or not equal to so equal to is represented by equal double equal to or not equal to is represented by not equal to let us see this with an example.

(Refer Slide Time: 01:32)



```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/ITMadras/ShellPrograms
1 #!/bin/bash
2
3 a=10
4 b=20
5 if [ $a == $b ]
6 then
7     echo "$a is equal to $b"
8 else
9     echo "$a is not equal to $b"
10 fi
11
12 b=10
13 if [ $a == $b ]
14 then
15     echo "$a is equal to $b"
16 else
17     echo "$a is not equal to $b"
18 fi
19
"iffi.sh" 19L, 200C
```

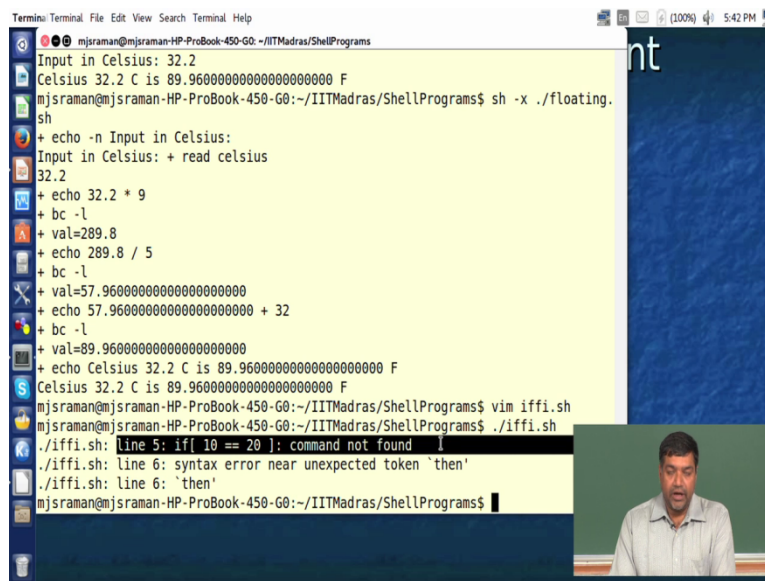
So what we have is an example something like this. So I have two variables a) which are assigned the value of 10 in line 3 of this program and then b) which has a value of 20 that is assigned in line 4 of this program.

So what I want to do right now is I want to see whether the value of a is equal to value of b. Obviously it is not equal and therefore what I do is I write a Syntax like this, I put an if statement, then I leave a space, then I start a square brace, then leave a space I give the variable name, again leave the space then put the two equal to sign,

Again leave the space, then I put the dollar b the value of b and then I give leave a space and then finally I close this. Now every space that I dictated is important. Even if you miss one value the shell will say it's an error.

So let us try to see whether the shell shows an error so let us assume that I do not put it like this now if you look at this since I am using a good editor it tells you immediately that there is an error. Anyway let's not bother about it.

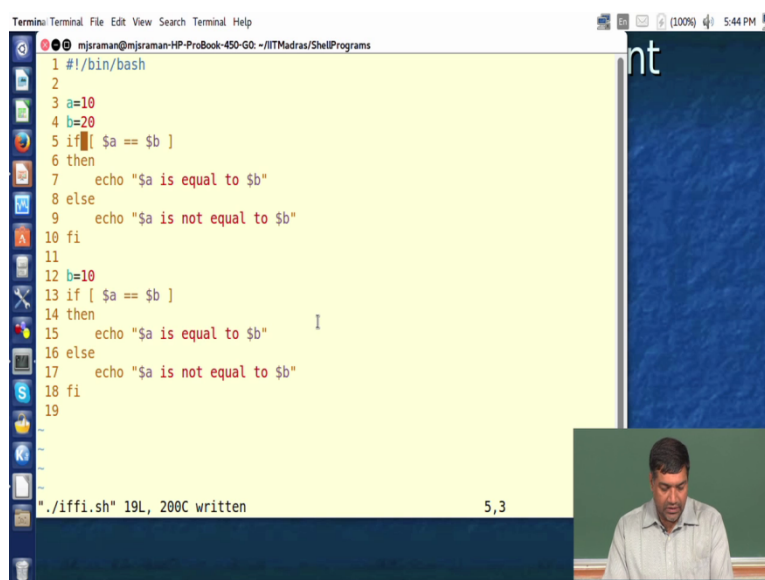
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```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
Input in Celsius: 32.2
Celsius 32.2 C is 89.960000000000000000000000000000 F
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ sh -x ./floating.
sh
+ echo -n Input in Celsius:
Input in Celsius: + read celsius
32.2
+ echo 32.2 * 9
+ bc -l
+ val=289.8
+ echo 289.8 / 5
+ bc -l
+ val=57.960000000000000000000000000000
+ echo 57.960000000000000000000000000000 + 32
+ bc -l
+ val=89.960000000000000000000000000000
+ echo Celsius 32.2 C is 89.960000000000000000000000000000 F
Celsius 32.2 C is 89.960000000000000000000000000000 F
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim iffi.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./iffi.sh
./iffi.sh: line 5: if[ 10 == 20 ]: command not found
./iffi.sh: line 6: syntax error near unexpected token `then'
./iffi.sh: line 6: `then'
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$
```

Let's try to run this program. So it immediately says in line number 5 there is an error command not found so you've to be extremely careful when you type this kind of programs in shell.

(Refer Slide Time: 03:08)



```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
1 #!/bin/bash
2
3 a=10
4 b=20
5 if[ $a == $b ]
6 then
7     echo "$a is equal to $b"
8 else
9     echo "$a is not equal to $b"
10 fi
11
12 b=10
13 if [ $a == $b ]
14 then
15     echo "$a is equal to $b"
16 else
17     echo "$a is not equal to $b"
18 fi
19
"./iffi.sh" 19L, 200C written
5,3
```

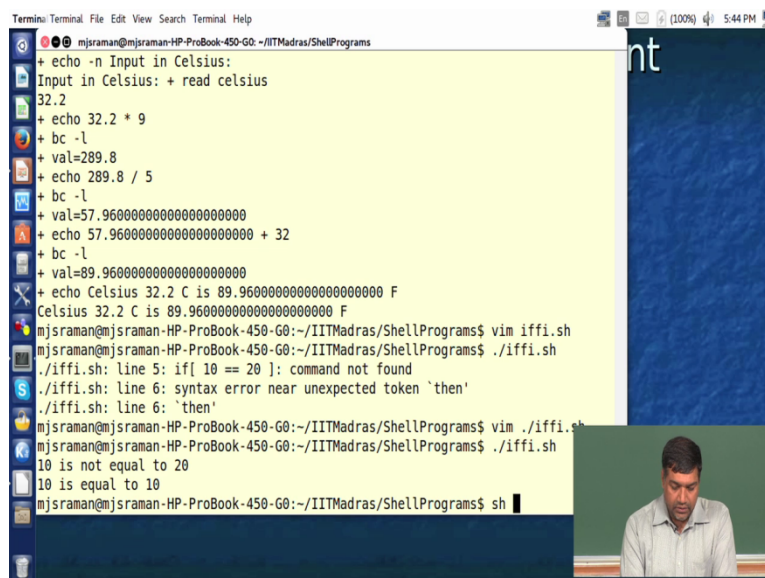
So let's return back. So in this case what I do is I compare these two values, now the if statement works in such a way that if I if these result of this turns out to be true ok, then the statements following then upto else is executed, see here I've written only one statement but you can have many statements written here.

So in this case for example if I give a value of 10 for a and 10 for b then this statement this becomes true this condition becomes true and once this condition becomes true then this part of the shell script will be executed. If suppose the condition becomes false as in this case for example here I have a 10 and 10 is definitely not equal to 20 then the else part of the code is executed.

Remember that when the then part of the code is executed finally the code skips the else part and then comes to the statement after this (04:14feed) so this is a marker ok this whole thing forms a line or a sentence but let's not get into those details so what happens is that so if you take this program sh the first statement that you get printed is this that 10 is not equal to 20 now what we do is now we try to make b also equal to 10.

So in this case and then repeat the same program and as discussed before this will print a is equal to b so let us see whether whatever we had seen is getting printed here.

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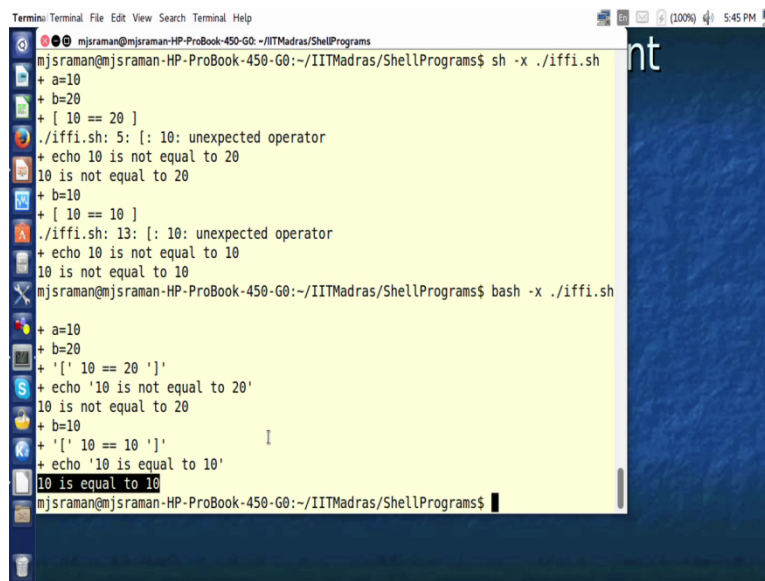
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Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
+ echo -n Input in Celsius:
Input in Celsius: + read celsius
32.2
+ echo 32.2 * 9
+ bc -l
+ val=289.8
+ echo 289.8 / 5
+ bc -l
+ val=57.960000000000000000000000000000
+ echo 57.960000000000000000000000000000 + 32
+ bc -l
+ val=89.960000000000000000000000000000
+ echo Celsius 32.2 C is 89.960000000000000000000000000000 F
Celsius 32.2 C is 89.960000000000000000000000000000 F
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim iffi.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./iffi.sh
./iffi.sh: line 5: if[ 10 == 20 ]: command not found
./iffi.sh: line 6: syntax error near unexpected token `then'
./iffi.sh: line 6: `then'
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim ./iffi.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./iffi.sh
10 is not equal to 20
10 is equal to 10
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ sh
```

The screenshot shows a terminal window with a dark background and a light blue title bar. The terminal displays the execution of a shell script named 'iffi.sh'. The script prompts for Celsius input, which is 32.2. It then calculates the Fahrenheit equivalent using 'bc' and 'val' variables, resulting in 89.96. The script then prints 'Celsius 32.2 C is 89.960000000000000000000000000000 F'. After editing the script with 'vim', it is run again. The first run shows a syntax error on line 6. The second run shows the script outputting '10 is not equal to 20' and '10 is equal to 10'. A small video inset in the bottom right corner shows a man in a light blue shirt looking at the screen.

So what we do is I run this program so it definitely Prints 10 is not equal to 20 and 10 is equal to 10.



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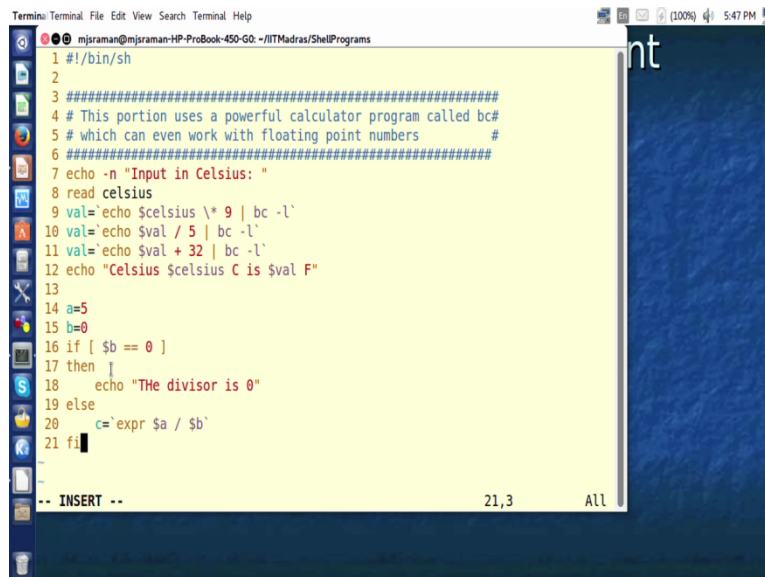
A terminal window titled 'Terminal' showing the execution of a script named 'iffi.sh'. The script contains two conditional blocks. The first block has a syntax error: '[: 10: unexpected operator' at line 5, followed by 'echo 10 is not equal to 20'. The second block also has a syntax error: '[: 10: unexpected operator' at line 13, followed by 'echo 10 is not equal to 10' and '10 is not equal to 10'. The user then runs the script in debug mode using 'bash -x ./iffi.sh'. The debug output shows the variable assignments 'a=10' and 'b=20', the evaluation of the first condition '[' 10 == 20 ']' which returns false, and the evaluation of the second condition '[' 10 == 10 ']' which returns true. The final output of the script is '10 is equal to 10'.

```
Terminal Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ sh -x ./iffi.sh
+ a=10
+ b=20
+ [ 10 == 20 ]
./iffi.sh: 5: [: 10: unexpected operator
+ echo 10 is not equal to 20
10 is not equal to 20
+ b=10
+ [ 10 == 10 ]
./iffi.sh: 13: [: 10: unexpected operator
+ echo 10 is not equal to 10
10 is not equal to 10
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ bash -x ./iffi.sh
+ a=10
+ b=20
+ '[' 10 == 20 ']'
+ echo '10 is not equal to 20'
10 is not equal to 20
+ b=10
+ '[' 10 == 10 ']'
+ echo '10 is equal to 10'
10 is equal to 10
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$
```

And we can also see this with the debug mode and in the debug mode you can see It is in the debug mode ok so in the debug mode if you see first is assigned the value of 10 to a it assigns the value of 10 20 to b then it compares a with b and it finds out that the result is not equal I mean this 10 is not equal to 20.

Therefore the else part is executed and it prints 10 is not equal to 20 now assigned a B to be value of 10 now if you look at this is 10 is equal to 10 therefore we print 10 is equal to 10. So this the Syntax for if statement I am just introducing this if statement now to tell you the number of possibilities using this what all are the things we can do.

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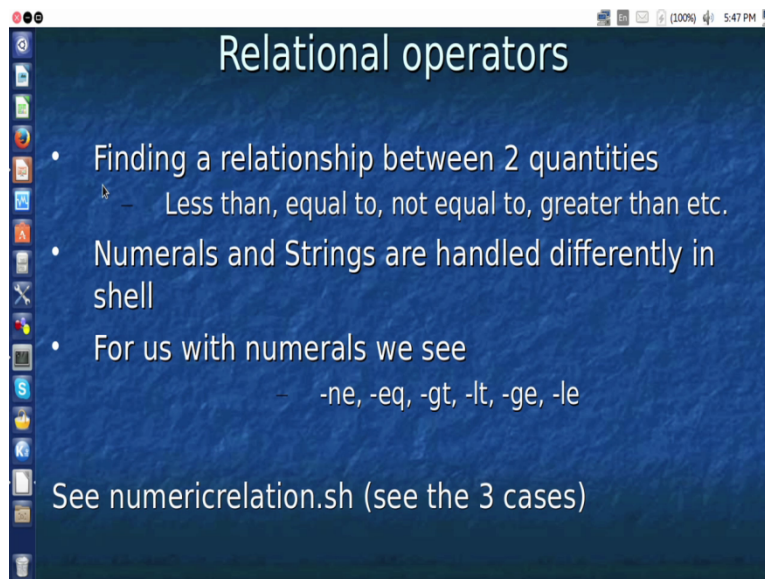
```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/ITMadras/ShellPrograms
1 #!/bin/sh
2
3 #####
4 # This portion uses a powerful calculator program called bc#
5 # which can even work with floating point numbers
6 #####
7 echo -n "Input in Celsius: "
8 read celsius
9 val=`echo $celsius \* 9 | bc -l`
10 val=`echo $val / 5 | bc -l`
11 val=`echo $val + 32 | bc -l`
12 echo "Celsius $celsius C is $val F"
13
14 a=5
15 b=0
16 if [ $b == 0 ]
17 then
18     echo "The divisor is 0"
19 else
20     c=`expr $a / $b`
21 fi
-- INSERT --
21,3 All
```

For example when in the previous code let us say we have a we have a let's say I just typed this so let's say I have a variable like this a is equal to 5 and then I want to say C is equal to say expression of dollar a divided by let's say dollar b ok

And let's assume that dollar b so b is given a value of zero now in this case the arithmetic operation itself will give if I divide a by b since b is zero it will give an error ok which you don't want to happen I mean sorry here so if a by b if b is zero dollar b is zero then it will give an error.

So what you could do is you could actually check by putting a condition like this if dollar b equal equal to say something like 0 then I can say then I can say print something like this echo the divisor is zero else we can go ahead and divide so such logic can be implemented in the code so that is the reason we saw why we have we have to use the if statements.

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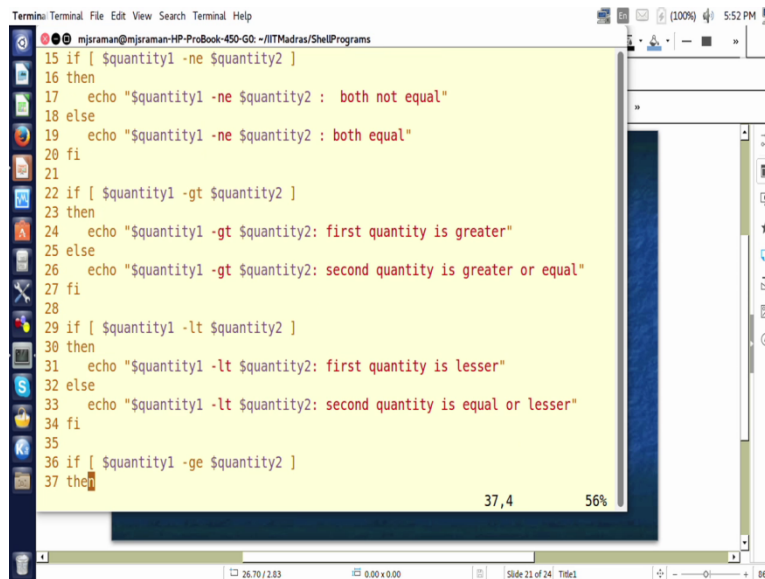


Now let us come to the relational operators ok a relational operator gives relationship between two quantities. What we can do is we can mix and match the relation operators along with the if statement so that is one of the reasons we introduce the if statements before so when we have two quantities then mathematically you can either have a I say two numeric quantities.

Then they can either be less than one can be less than the other one can be equal to the other one cannot be equal to the other one can be greater than the other etc now in shell the numerals and strings are handle in the same fashion ok therefore what we will be seeing in shell is for numerals we will be using these symbols minus me minus equal to minus gt minus lt minus g minus l which represents not equal to equal to greater than or greater than less than greater than or equal to and less than or equal to.

So when you are doing numeric comparisons you are supposed to use these symbols this is slightly odd ok because in general we will be using the keyboard values of less than greater than and all that so for those people who had done other programming languages this will looks slightly odd but that's the way shell is.

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```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/ITMadras/ShellPrograms
15 if [ $quantity1 -ne $quantity2 ]
16 then
17     echo "$quantity1 -ne $quantity2 : both not equal"
18 else
19     echo "$quantity1 -ne $quantity2 : both equal"
20 fi
21
22 if [ $quantity1 -gt $quantity2 ]
23 then
24     echo "$quantity1 -gt $quantity2: first quantity is greater"
25 else
26     echo "$quantity1 -gt $quantity2: second quantity is greater or equal"
27 fi
28
29 if [ $quantity1 -lt $quantity2 ]
30 then
31     echo "$quantity1 -lt $quantity2: first quantity is lesser"
32 else
33     echo "$quantity1 -lt $quantity2: second quantity is equal or lesser"
34 fi
35
36 if [ $quantity1 -ge $quantity2 ]
37 then
```

So let us try to identify how to do this? So we will look at numeric relation dot sh. So this is a slightly complicated program where we try to explain all the the quantity so let us start from line number 3 so we are comparing our idea is to compare two quantities

So we are taking up quantity one which is a value of 1000 and quantity two which is value of 100 what we will do is when you are demonstrating program we will actually change the values from 1000 to 100 or 100 and 1000 then we will interchange the values and see how the program works.

So let us go through the program line by line and this is one of the methods by which you also debug your program see the the writing shell script is excellent but one of the things that you should do while writing a shell script is to do a line by line activity ok this is a technical term for this known as the code walk through ok what I do is I actually behave like a computer and then see whether my code works as desired.

So let us do this let's start with line number 3 so the quantity 1 is assigned the value of 1000 and quantity 2 is assigned the value of 100 so let's remember this so the next statement actually echo saying that we are comparing quantity 1 with quantity 2 now so third statement line number 8 says that if quantity 1 and if you'll look at this this minus e eq which says that equal to.

So this tries to check whether quantity 1 is equal to quantity 2 ok and if you will look at this look at the space here after the if now this is very important I am insisting again and again

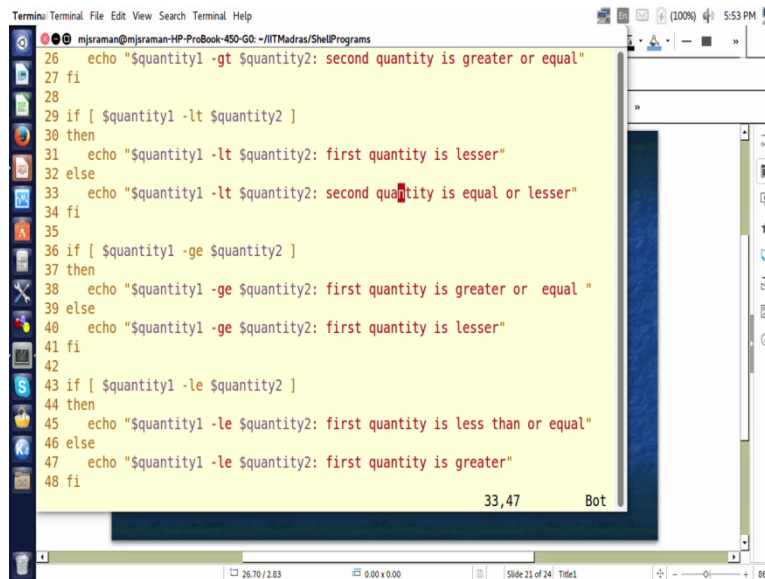
because people tell to forgets this and then it gives lot of errors and if you look at this if quantity 1 is equal to quantity 2 then says both are equal if not they say both are not equal.

So in our case if quantity 1 is 1000 and quantity 2 is 100 then they are not equal therefore we believe that this else part will be printed so let's remember this because when we run this program we should see whether whatever we had gone through as code walk through and whatever is printed program both are the same.

Now coming to line number 15 we are using the minus one that is not equal to quantity so if you look at this then it says quantity 1 is not equal to quantity 2 because 1000 is not equal to 100 then this line will be printed that is both not equal will be printed and let's move on so if you look at this then we will come to the line number line number 22 here these tries to find out whether quantity 1 is greater that quantity 2.

And obviously we had given quantity 1 the value of 1000 and quantity 2 the value of 100 therefore it will print the first quantity is greater moving on to line 29 we are trying to see whether the first quantity is less than the second quantity the first quantity is 1000 the second quantity is 100 and obviously 1000 is not less than 100 therefore what will it print, it will print make a guess so since 1000 is not less than 100 it will print second quantity is equal or lesser is it true let's see let's execute the program and see please note it down.

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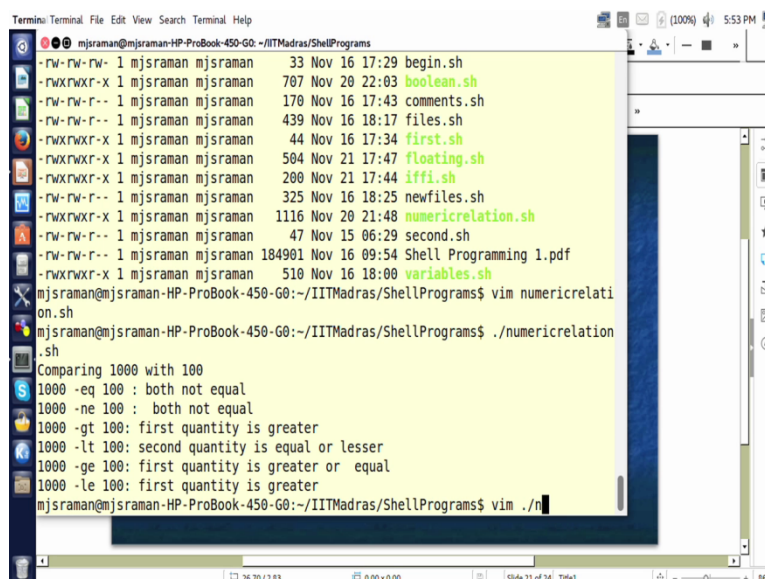


```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
26 echo "$quantity1 -gt $quantity2: second quantity is greater or equal"
27 fi
28
29 if [ $quantity1 -lt $quantity2 ]
30 then
31 echo "$quantity1 -lt $quantity2: first quantity is lesser"
32 else
33 echo "$quantity1 -lt $quantity2: second quantity is equal or lesser"
34 fi
35
36 if [ $quantity1 -ge $quantity2 ]
37 then
38 echo "$quantity1 -ge $quantity2: first quantity is greater or equal "
39 else
40 echo "$quantity1 -ge $quantity2: first quantity is lesser"
41 fi
42
43 if [ $quantity1 -le $quantity2 ]
44 then
45 echo "$quantity1 -le $quantity2: first quantity is less than or equal"
46 else
47 echo "$quantity1 -le $quantity2: first quantity is greater"
48 fi
33,47 Bot
```

Now coming to line number 36 we are trying to check whether quantity 1 is greater than or equal to quantity 2. Similarly we are trying to check whether 1000 is greater than equal to hundred which is true therefore it will print first quantity is greater than or equal.

And finally we are trying to see whether first quantity is less than or equal to quantity 2 obviously know that the first quantity is greater than equal to therefore it will print first quantity is greater. So let us see except for this line we are pretty clear about rest of the lines hopefully let's run this program and then see.

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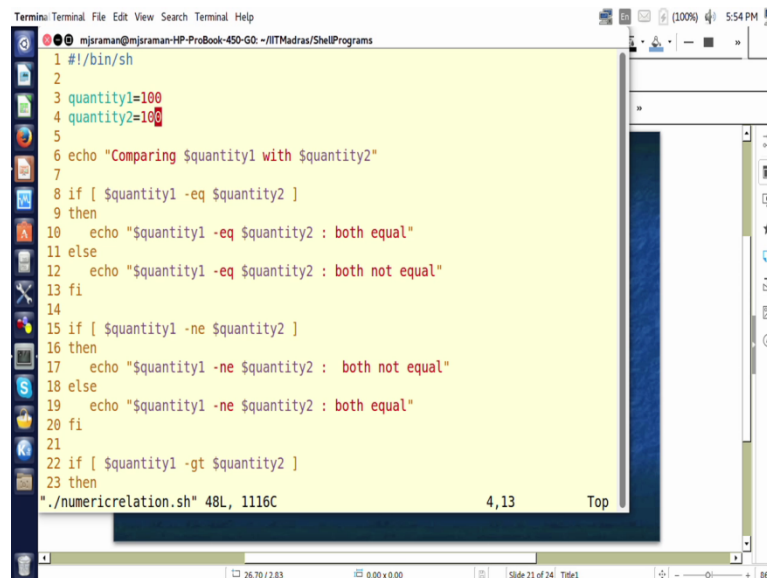


```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
-rw-rw-r--r-- 1 mjsraman mjsraman 33 Nov 16 17:29 begin.sh
-rwxrwxr-x 1 mjsraman mjsraman 707 Nov 20 22:03 boolean.sh
-rw-rw-r--r-- 1 mjsraman mjsraman 170 Nov 16 17:43 comments.sh
-rw-rw-r--r-- 1 mjsraman mjsraman 439 Nov 16 18:17 files.sh
-rwxrwxr-x 1 mjsraman mjsraman 44 Nov 16 17:34 first.sh
-rwxrwxr-x 1 mjsraman mjsraman 504 Nov 21 17:47 floating.sh
-rwxrwxr-x 1 mjsraman mjsraman 200 Nov 21 17:44 iffi.sh
-rw-rw-r--r-- 1 mjsraman mjsraman 325 Nov 16 18:25 newfiles.sh
-rwxrwxr-x 1 mjsraman mjsraman 1116 Nov 20 21:48 numericrelation.sh
-rw-rw-r--r-- 1 mjsraman mjsraman 47 Nov 15 06:29 second.sh
-rw-rw-r--r-- 1 mjsraman mjsraman 184901 Nov 16 09:54 Shell Programming 1.pdf
-rwxrwxr-x 1 mjsraman mjsraman 510 Nov 16 18:00 variables.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim numericrelation.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./numericrelation.sh
Comparing 1000 with 100
1000 -eq 100 : both not equal
1000 -ne 100 : both not equal
1000 -gt 100: first quantity is greater
1000 -lt 100: second quantity is equal or lesser
1000 -ge 100: first quantity is greater or equal
1000 -le 100: first quantity is greater
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim ./n
```



So we will run this program called a numeric relation and it says both are not both are not equal I think we've got this correct we got first quantity is greater correct ok and second quantity this is I think we got it correct too and I think first we also got this correct so we got everything correct here ok? So this is one way to identify whether your program is working right or not of course this is only one of the test case so what we should do here is?

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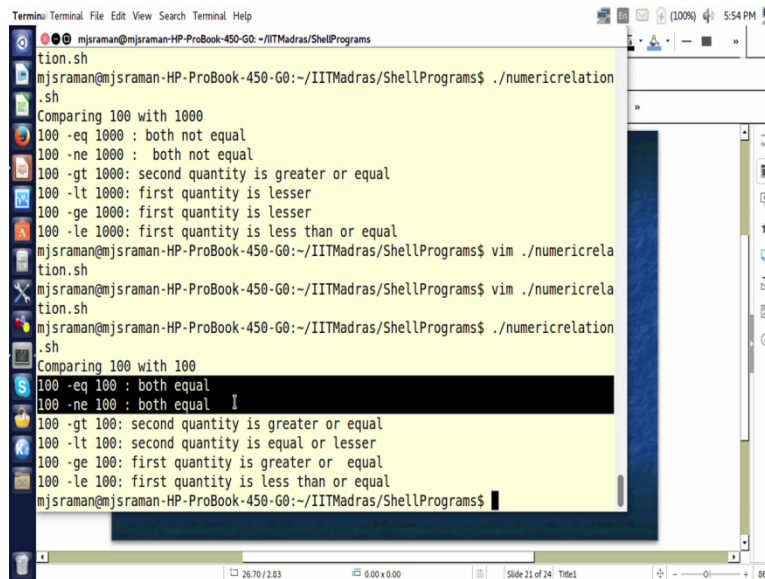


```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/ITMadras/ShellPrograms

1 #!/bin/sh
2
3 quantity1=100
4 quantity2=1000
5
6 echo "Comparing $quantity1 with $quantity2"
7
8 if [ $quantity1 -eq $quantity2 ]
9 then
10  echo "$quantity1 -eq $quantity2 : both equal"
11 else
12  echo "$quantity1 -eq $quantity2 : both not equal"
13 fi
14
15 if [ $quantity1 -ne $quantity2 ]
16 then
17  echo "$quantity1 -ne $quantity2 : both not equal"
18 else
19  echo "$quantity1 -ne $quantity2 : both equal"
20 fi
21
22 if [ $quantity1 -gt $quantity2 ]
23 then
24  echo "$quantity1 -gt $quantity2 : both not equal"
25 else
26  echo "$quantity1 -gt $quantity2 : both equal"
27 fi
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29 exit 0
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```

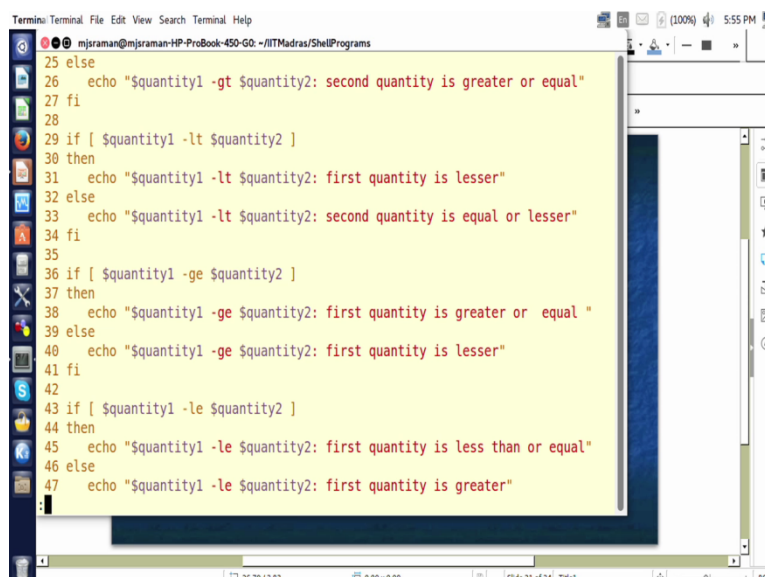
(Refer Slide Time: 14:49)



```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
tion.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./numericrelation
.sh
Comparing 100 with 1000
100 -eq 1000 : both not equal
100 -ne 1000 : both not equal
100 -gt 1000: second quantity is greater or equal
100 -lt 1000: first quantity is lesser
100 -ge 1000: first quantity is lesser
100 -le 1000: first quantity is less than or equal
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim ./numericrelation
tion.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim ./numericrelation
tion.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./numericrelation
.sh
Comparing 100 with 100
100 -eq 100 : both equal
100 -ne 100 : both equal
100 -gt 100: second quantity is greater or equal
100 -lt 100: second quantity is equal or lesser
100 -ge 100: first quantity is greater or equal
100 -le 100: first quantity is less than or equal
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$
```

So this is something so here it says both are equal ok so mathematic so probably I mean why so does it look like a 1 because 100 not equal to 100 ok if it is true then the answer will be different since it is false ok 100 is equal to 100 we are printing both are equal so this also prints correctly ok and then this way we can use the numeric operators now so let's take a look at this program first.

(Refer Slide Time: 15:34)



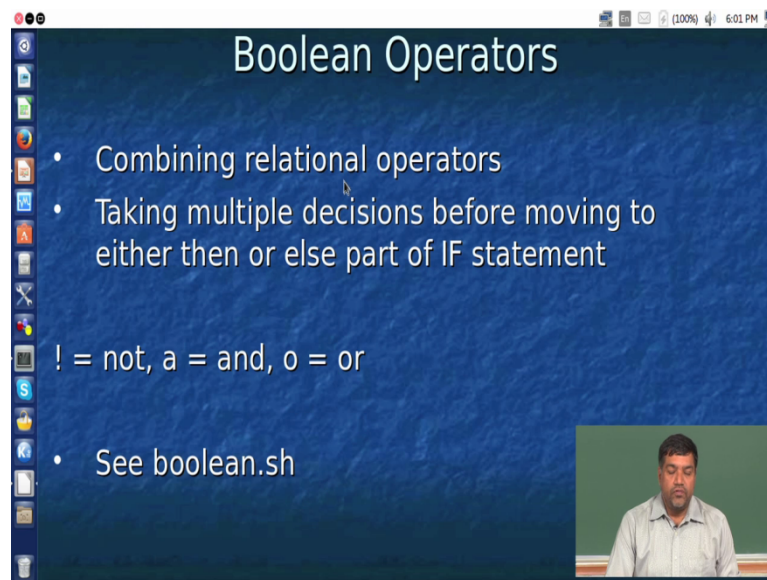
```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
25 else
26     echo "$quantity1 -gt $quantity2: second quantity is greater or equal"
27 fi
28
29 if [ $quantity1 -lt $quantity2 ]
30 then
31     echo "$quantity1 -lt $quantity2: first quantity is lesser"
32 else
33     echo "$quantity1 -lt $quantity2: second quantity is equal or lesser"
34 fi
35
36 if [ $quantity1 -ge $quantity2 ]
37 then
38     echo "$quantity1 -ge $quantity2: first quantity is greater or equal "
39 else
40     echo "$quantity1 -ge $quantity2: first quantity is lesser"
41 fi
42
43 if [ $quantity1 -le $quantity2 ]
44 then
45     echo "$quantity1 -le $quantity2: first quantity is less than or equal"
46 else
47     echo "$quantity1 -le $quantity2: first quantity is greater"
48 fi
```

So hope we've clear with this program ok so I would suggest that you type these programs so it is nice to listen to lectures but scripting only you can do scripting only when you type it in your computer and then check the results.

Now moving on let us so we saw this we also saw the three cases the first case where the first quantity was less than second quantity in the second case the second quantity was less than first quantity and so on and then both quantities being equal.

Now you should understand that when you write a shell script you should not only write the code but you should also do a code walk through as well as run some unit testing so what we did was a sample of a unit test to ensure that our shell scripting is correct ok.

(Refer Slide Time: 16:22)



The image shows a presentation slide titled "Boolean Operators" on a dark blue background. The slide contains the following text:

- Combining relational operators
- Taking multiple decisions before moving to either then or else part of IF statement

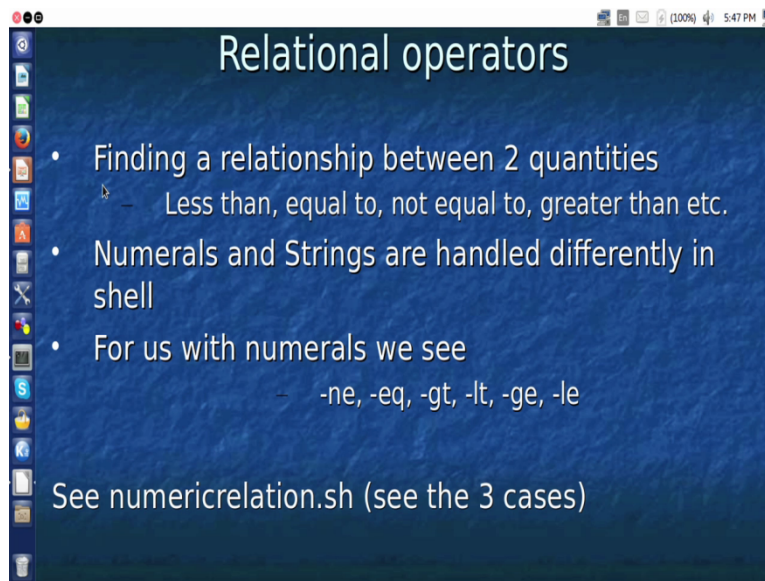
! = not, a = and, o = or

- See boolean.sh

In the bottom right corner, there is a small video inset showing a man with a beard and glasses, wearing a light-colored shirt, speaking.

Now let's move on to Boolean operators, so why do we need Boolean operators ok the three Boolean operators that are given are not and and or and these are represented by the exclamation mark as given here the exclamation mark is represents not the a represents and and the o represents r now why do we need these three Boolean operators 1 the first reason is this you can combine the relation operators and take a Boolean decision either true or false.

(Refer Slide Time: 16:55)



The slide is titled "Relational operators" and is displayed in a window with a Linux-style desktop environment. The title is at the top center in a large, white, sans-serif font. Below the title, there is a list of three bullet points in a smaller, white, sans-serif font. The first bullet point is "Finding a relationship between 2 quantities", followed by a sub-bullet "Less than, equal to, not equal to, greater than etc.". The second bullet point is "Numerals and Strings are handled differently in shell". The third bullet point is "For us with numerals we see", followed by a sub-bullet "-ne, -eq, -gt, -lt, -ge, -le". At the bottom of the slide, there is a line of text "See numericrelation.sh (see the 3 cases)". The background of the slide is a dark blue, textured surface. The window's title bar and a vertical sidebar of application icons are visible on the left.

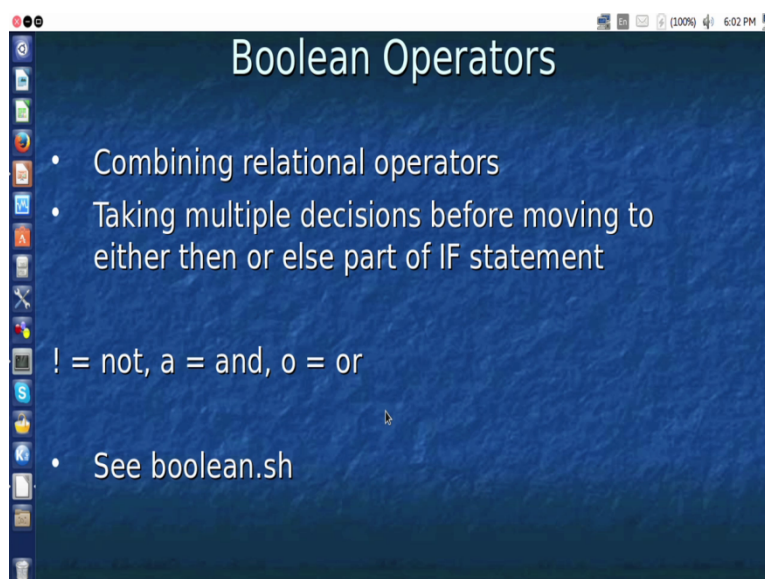
## Relational operators

- Finding a relationship between 2 quantities
  - Less than, equal to, not equal to, greater than etc.
- Numerals and Strings are handled differently in shell
- For us with numerals we see
  - -ne, -eq, -gt, -lt, -ge, -le

See numericrelation.sh (see the 3 cases)

So if you look at what we did with the relation operators we were trying to find out whether one quantity is equal to the other quantity so when we compare two quantities and ask a question whether a quantity is equal to the other quantity the obvious answer could be either yes it is equal or it is not equal so when it is equal we say that with the condition that e equal to condition then we say that this statement becomes true.

(Refer Slide Time: 17:22)



The slide is titled "Boolean Operators" and is displayed in a window with a Linux-style desktop environment. The title is at the top center in a large, white, sans-serif font. Below the title, there is a list of three bullet points in a smaller, white, sans-serif font. The first bullet point is "Combining relational operators". The second bullet point is "Taking multiple decisions before moving to either then or else part of IF statement". Below these two bullet points, there is a line of text "!= not, a = and, o = or". The third bullet point is "See boolean.sh". The background of the slide is a dark blue, textured surface. The window's title bar and a vertical sidebar of application icons are visible on the left.

## Boolean Operators

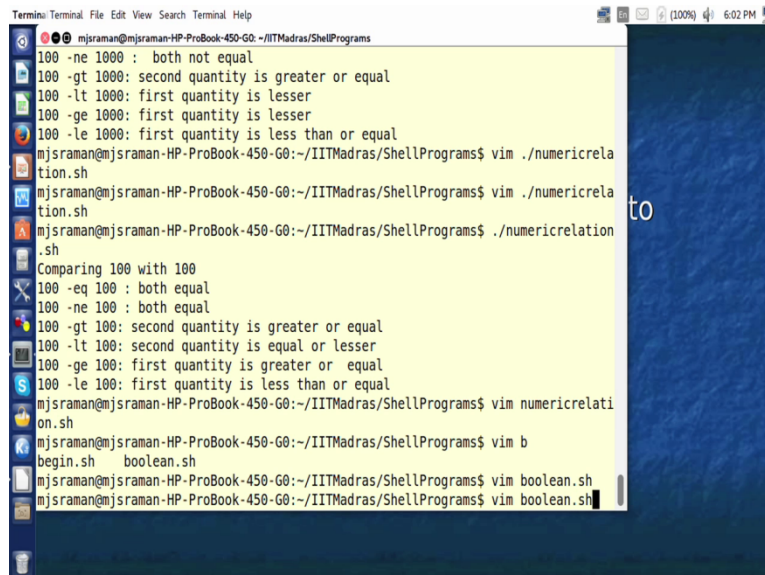
- Combining relational operators
- Taking multiple decisions before moving to either then or else part of IF statement

!= not, a = and, o = or

- See boolean.sh

So we can combine such multiple decisions using the relational operator so the idea is so we will see this and we can insert this decision making process into the if statement part we will still see this with an example.

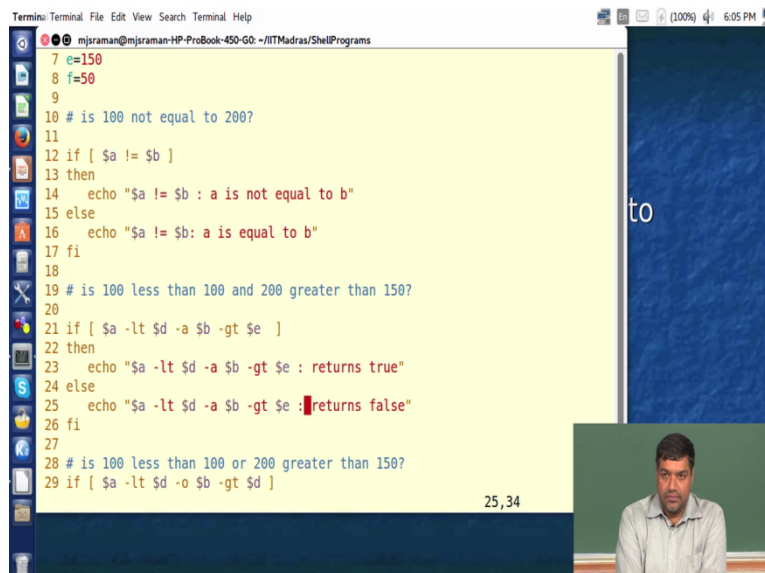
(Refer Slide Time: 17:42)



```
Termin@ Terminal: File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
100 -ne 1000 : both not equal
100 -gt 1000: second quantity is greater or equal
100 -lt 1000: first quantity is lesser
100 -ge 1000: first quantity is lesser
100 -le 1000: first quantity is less than or equal
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim ./numericrelation.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim ./numericrelation.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./numericrelation.sh
Comparing 100 with 100
100 -eq 100 : both equal
100 -ne 100 : both equal
100 -gt 100: second quantity is greater or equal
100 -lt 100: second quantity is equal or lesser
100 -ge 100: first quantity is greater or equal
100 -le 100: first quantity is less than or equal
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim numericrelation.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim b
begin.sh boolean.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim boolean.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim boolean.sh
```

So what we have is a program called Boolean dot sh, ok?

(Refer Slide Time: 17:47)



```
Termin@ Terminal: File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
7 e=150
8 f=50
9
10 # is 100 not equal to 200?
11
12 if [ $a != $b ]
13 then
14 echo "$a != $b : a is not equal to b"
15 else
16 echo "$a != $b: a is equal to b"
17 fi
18
19 # is 100 less than 100 and 200 greater than 150?
20
21 if [ $a -lt $d -a $b -gt $e ]
22 then
23 echo "$a -lt $d -a $b -gt $e : returns true"
24 else
25 echo "$a -lt $d -a $b -gt $e : returns false"
26 fi
27
28 # is 100 less than 100 or 200 greater than 150?
29 if [ $a -lt $d -o $b -gt $d ]
25,34
```

And in this case we are trying to have 6 variables a b c d e f ok the variable name should be meaningful but since this is an example we've taken this variables names to be a b c d e f in



your programs we expect meaningful names to be given to these variables so let's start with our program so I assume a be value of 100, b to be 200 and c to be 1000.

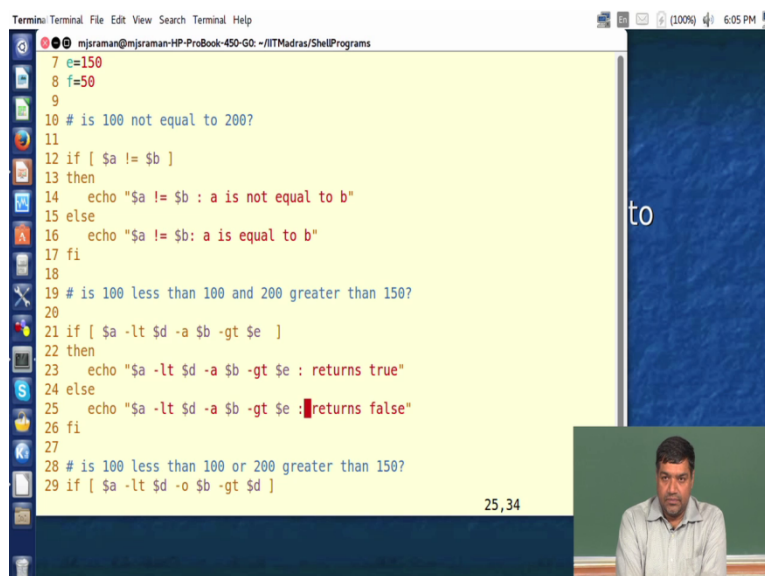
So let us take this statement 12. So we are trying to find out whether a is not equal to b ok? That is 100 is not equal to 200 yes 100 is not equal to 200 therefore this needs to be true and if it is true the condition will evaluation of the condition becomes true then the then part is executed. Therefore we will get this printed.

Now the most interesting line now here is line number 21. So here you look at this we are joining 2 relational operators together using the Boolean operator. So if you look at this quantity dollar a is less than d ok?

This is the first condition the relational operation now dollar b is greater than dollar e this is the second relational operation and both of these are combined with an and condition. So what happens is that in this case there are four possibilities so a can be this first expression ok a minus 100 dollar d can be 2 and this can be 2 these both are 2 then this 2 statement gets executed.

If a less than 3 is less than dollar d is false and b greater than dollar e is false then we will execute this statement which says return false. If the first relation operator evaluates to be true and the second operator evaluates to be false then false will be printed. Similarly if this evaluates to be false and the second relational operator evaluates to be true even then false will be printed. So this exactly follows the Boolean logic of an and gate.

(Refer Slide Time: 20:12)



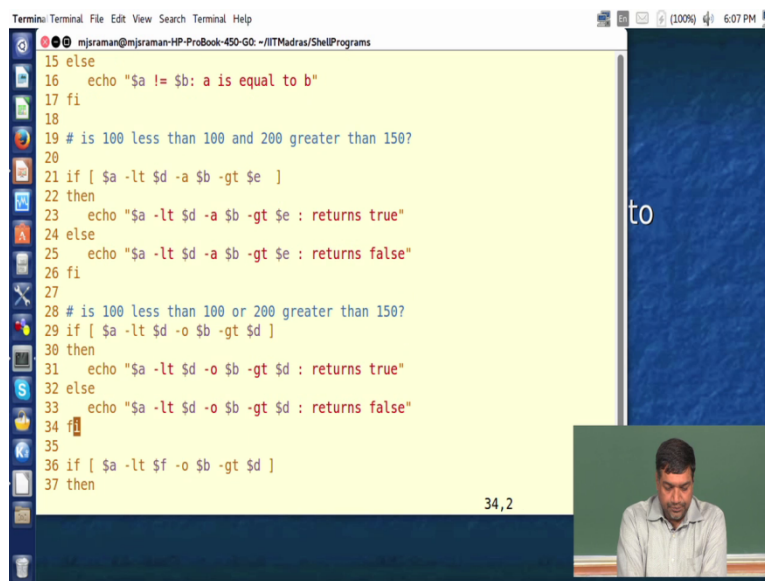
```
Terminal: Terminal File Edit View Search Terminal Help
mjspraman@mjspraman-HP-ProBook-450-G0: ~/IT/Madras/ShellPrograms

7 a=100
8 b=200
9
10 # is 100 not equal to 200?
11
12 if [ $a != $b ]
13 then
14     echo "$a != $b : a is not equal to b"
15 else
16     echo "$a != $b: a is equal to b"
17 fi
18
19 # is 100 less than 100 and 200 greater than 150?
20
21 if [ $a -lt $d -a $b -gt $e ]
22 then
23     echo "$a -lt $d -a $b -gt $e : returns true"
24 else
25     echo "$a -lt $d -a $b -gt $e : returns false"
26 fi
27
28 # is 100 less than 100 or 200 greater than 150?
29 if [ $a -lt $d -o $b -gt $d ]
```



Similarly the next statement follows the Boolean logic of the OR gate which tells you that either this relational operation a less than d or b greater than d if any one of them is true or both of them are true then it will return true the statement will return true in any other condition it will return false. Similarly in this case we are again using the OR condition ok? And we can also use the NOT condition as given that we leave it as a exercise so here is an example of we also use in NOT condition if you remember we have also used this during the relational operator numeric comparison case equal to or not equal to.

(Refer Slide Time: 20:55)

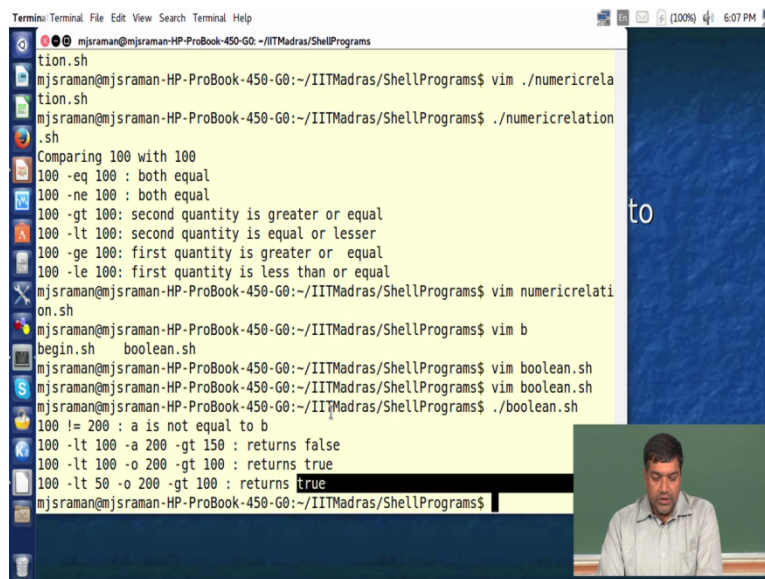


```
15 else
16   echo "$a != $b: a is equal to b"
17 fi
18
19 # is 100 less than 100 and 200 greater than 150?
20
21 if [ $a -lt $d -a $b -gt $e ]
22 then
23   echo "$a -lt $d -a $b -gt $e : returns true"
24 else
25   echo "$a -lt $d -a $b -gt $e : returns false"
26 fi
27
28 # is 100 less than 100 or 200 greater than 150?
29 if [ $a -lt $d -o $b -gt $e ]
30 then
31   echo "$a -lt $d -o $b -gt $e : returns true"
32 else
33   echo "$a -lt $d -o $b -gt $e : returns false"
34 fi
35
36 if [ $a -lt $f -o $b -gt $d ]
37 then
```

Now let us try to look at this example ok so is 100 not equal to 200 yes 100 not equal to 200 therefore what will print here if a is not equal to b then if 100 is less than 200 and 200 greater than 150 so 100 is definitely not less than 100 because 100 and 100 are equal and 200 is definitely greater than 100 therefore this is an AND condition so the first condition is false and the second condition is true since we are combining this with an AND the result should be a false.

And the third one is 100 less than 100 or 200 greater than 150, so 100 is not less than 100 , 100 is equal to 100 ok? And 200 is definitely greater than 150 and we are combining with an OR condition therefore it should return a true and then the last statement if a is 100 and f is 50 then the first statement is false and if b is 200 and d is 100 next statement is true therefore it will return true. So let us run this program and see whether we are getting this answer.

(Refer Slide Time: 22:07)



The screenshot shows a terminal window with the following content:

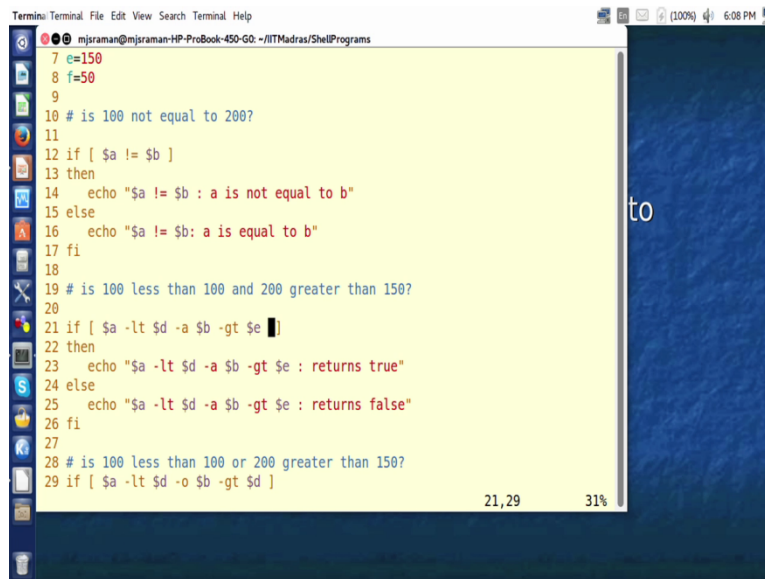
```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IITMadras/ShellPrograms
tion.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim ./numericrela
tion.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./numericrelati
on.sh
Comparing 100 with 100
100 -eq 100 : both equal
100 -ne 100 : both equal
100 -gt 100: second quantity is greater or equal
100 -lt 100: second quantity is equal or lesser
100 -ge 100: first quantity is greater or equal
100 -le 100: first quantity is less than or equal
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim numericrelati
on.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim b
begin.sh boolean.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim boolean.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ vim boolean.sh
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$ ./boolean.sh
100 != 200 : a is not equal to b
100 -lt 100 -a 200 -gt 150 : returns false
100 -lt 100 -o 200 -gt 100 : returns true
100 -lt 50 -o 200 -gt 100 : returns true
mjsraman@mjsraman-HP-ProBook-450-G0:~/IITMadras/ShellPrograms$
```

A video inset in the bottom right corner shows a man speaking.

So if 100 is not equal to 200 so look at this 100 less than 100 is false and therefore the whole statement returns false now 100 less than 100 is false but 200 greater than 100 is true therefore the whole statement returns 2 100 less than 50 is false and 200 greater than 100 is true therefore the statement returns true.

So in this way we can make conditions more and more complex by combining the relational operators and the Boolean operators. One thing that we should remember is ok it is all nice to write such complicated programs but the user should be able to understand the logic that you write therefore the first rule in any programming is that you should avoid very complex conditions, if there are very complex conditions you need to break down into simpler conditions and then do the coding.

(Refer Slide Time: 23:04)



```
Terminal: Terminal File Edit View Search Terminal Help
mjsraman@mjsraman-HP-ProBook-450-G0: ~/IT/ITMadras/ShellPrograms
7 e=150
8 f=50
9
10 # is 100 not equal to 200?
11
12 if [ $a != $b ]
13 then
14     echo "$a != $b : a is not equal to b"
15 else
16     echo "$a != $b: a is equal to b"
17 fi
18
19 # is 100 less than 100 and 200 greater than 150?
20
21 if [ $a -lt $d -a $b -gt $e ]
22 then
23     echo "$a -lt $d -a $b -gt $e : returns true"
24 else
25     echo "$a -lt $d -a $b -gt $e : returns false"
26 fi
27
28 # is 100 less than 100 or 200 greater than 150?
29 if [ $a -lt $d -o $b -gt $d ]
```

So for example a condition like this could as well be split and this is of course there are only two conditions you can also add OR and AND and so on that would be lot of larger Boolean expressions that you can evaluate.

But it is always better that you do not have more than two conditions otherwise it becomes very the program becomes very complex for you to read and understand and if there are any problems with coding too it is very difficult to debug such kind of problems. Logical errors are always difficult to debug, so please be very careful when you are using these kinds of Boolean operators.

Thank You!