CSI31 Lecture 7

Topics:

- 7.3 Multi-way Decisions
- 7.4 Exception Handling (part of the section)
- 7.5 Study in Design: Max of Three

7. 3 Multi-way Decisions

One-way decisions *if*

```
if <condition>:
   body
```

Two-way decisions *if-else*

```
if <condition>:
   statements
else:
   statements
```

7. 3 Multi-way Decisions

One-way decisions *if*

```
if <condition>:
   body
```

Two-way decisions *if-else*

```
if <condition>:
   statements
else:
   statements
```

Multi-way decisions *if-elif-else*:

```
if <condition1>:
   <case 1 statements>
elif <condition2>:
   <case 2 statements>
elif <condition3>:
   <case 3 statements>
...
elif <conditionn>:
   <case n statements>
else:
   <default statements>
```

7. 3 Multi-way Decisions

Example: *Solving quadratic equations*

$ax^2+bx+c = 0$

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

Discriminant $D=b^2-4ac$

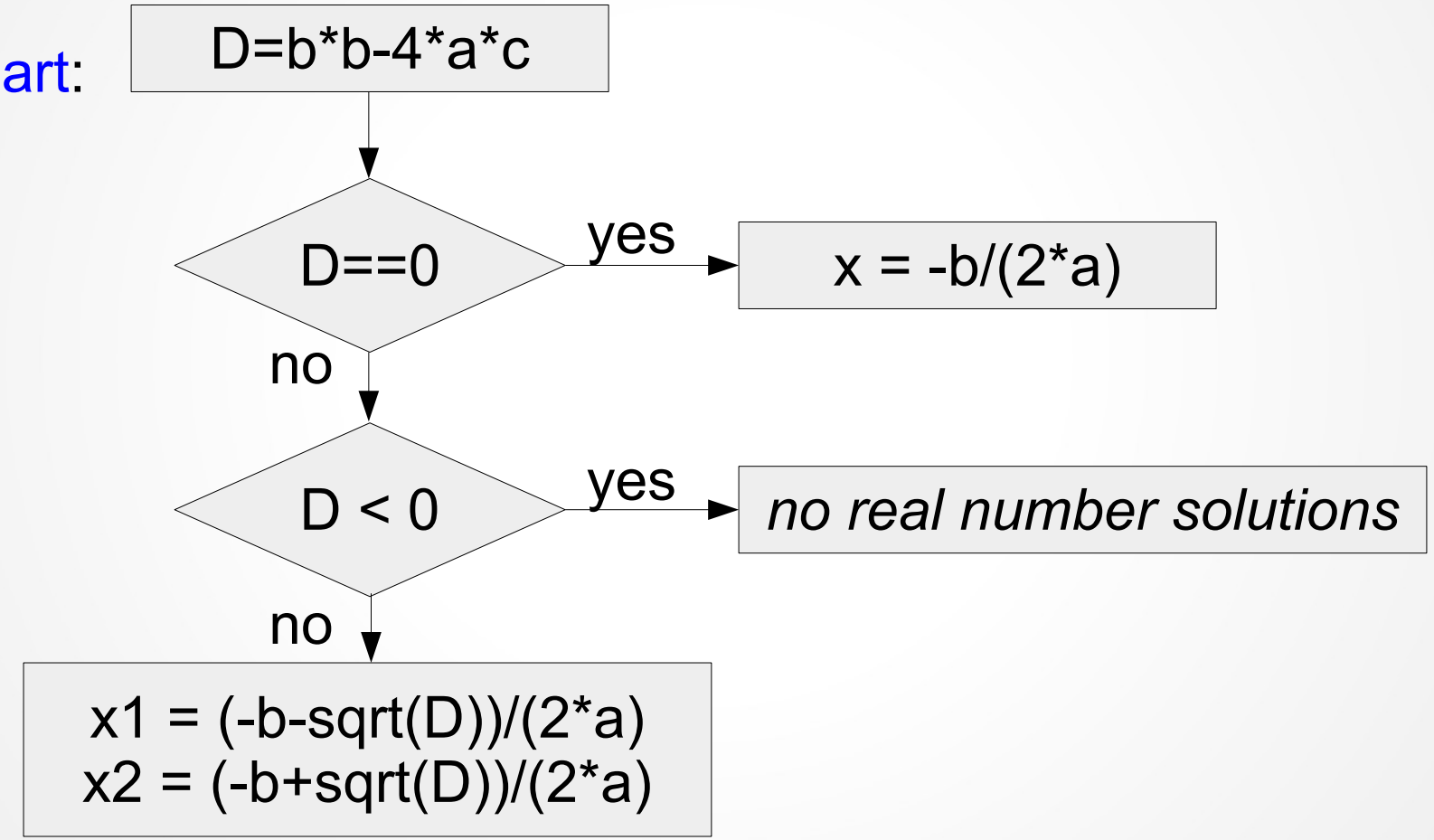
if $D = 0$, there is only one solution
if $D < 0$, there are no real number solutions
if $D > 0$, there are two solutions.

7. 3 Multi-way Decisions

Example: *Solving quadratic equations*

$ax^2+bx+c = 0$

flowchart:



7. 3 Multi-way Decisions

With *if*:

```
...
if  (discr == 0):
    find one root

if (discr < 0):
    no real roots

if (discr > 0):
    find two roots
```

With *if-else*:

```
...
if  (discr == 0):
    find one root

else:
    if (discr < 0):
        no real roots

    else:
        find two roots
```

With *if-elif-else*:

```
...
if  (discr == 0):
    find one root

elif (discr < 0):
    no real roots

else:
    find two roots
```

see programs: quadratic-equation.py, quadratic-equation_mod.py

7.4 Exception Handling

Let's use the same example: solving a quadratic equation

we checked whether the radicand is less than zero **before** the call to sqrt function.

Sometimes the programs become too crowded with decisions to check for special cases that the main algorithm for handling the run-of-the-mill cases seems completely lost.

Programming language designers have come up with mechanisms for *exception handling* that helps to solve this design problem.

7.4 Exception Handling

syntax:

```
try:
   <body>
except <ErrorType>
   <handler>
```

what to do in case if something failed in <body>

«Do these steps and if there is a problem, handle it this way»

7.4 Exception Handling

Consider another program that solves quadratic equation:

```
def main():
    print("This program solves ...")

    try:
        import math
        a = float(input("Enter coefficient a:"))
        b = float(input("Enter coefficient b:"))
        c = float(input("Enter coefficient c:"))
        discrRoot = math.sqrt(b*b-4*a*c)
        root1=(-b+discrRoot)/(2*a)
        root2=(-b-discrRoot)/(2*a)
        print("The roots are:", root1,root2)
    except ValueError:
        print("No real roots")

main()
```

7.4 Exception Handling

Please, note that `ValueError` is the name of the error that arises when the program tries to extract a square root of a negative number

type the following in the Python interactive window:

```
>>> import math
>>> math.sqrt(-10)
```

see what's the error name

see the more sophisticated program in quadratic-another2.py

7.5 Study in Design: Max of Three

Let's write a program that finds the maximum of three numbers (a,b,c).

There are more than one way of finding the maximum:

1. Compare each to all
2. Decision tree
3. Sequential processing
4. Use already written by somebody function

7.5 Study in Design: Max of Three

1. Compare each to all

idea:

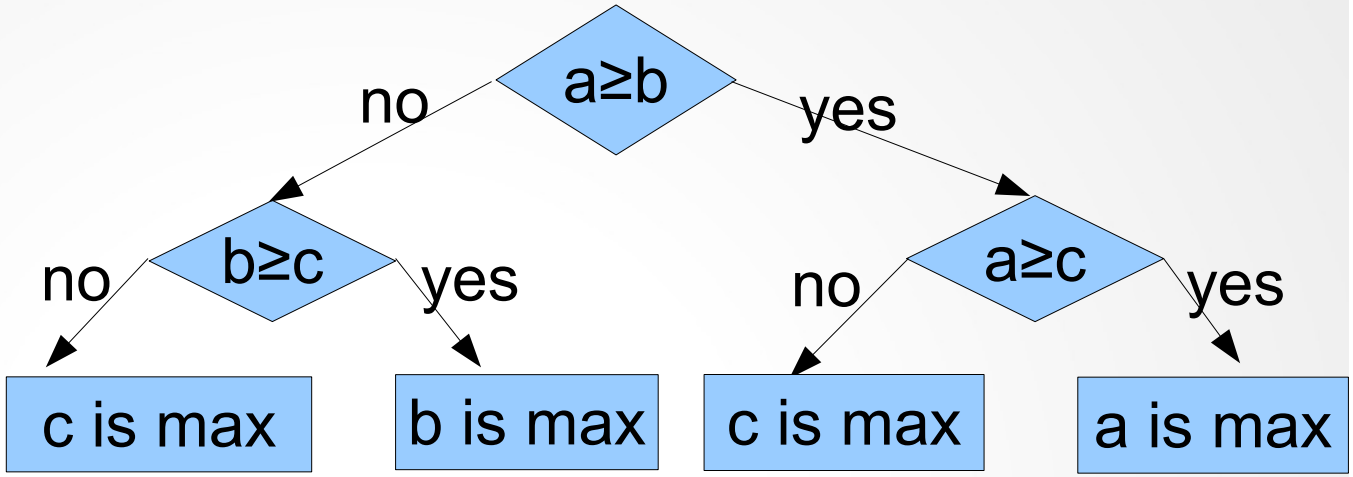
If a ≥ b and a ≥ c then a is maximum
If b ≥ a and b ≥ c then b is maximum
If c ≥ a and c ≥ b then c is maximum

...

```
    if a >= b and a >= c:
        max = a
    elif b >= a and b >= c:
        max = b
    else:
        max = c

    print("The maximum is", max)
```

7.5 Study in Design: Max of Three

2. Decision tree

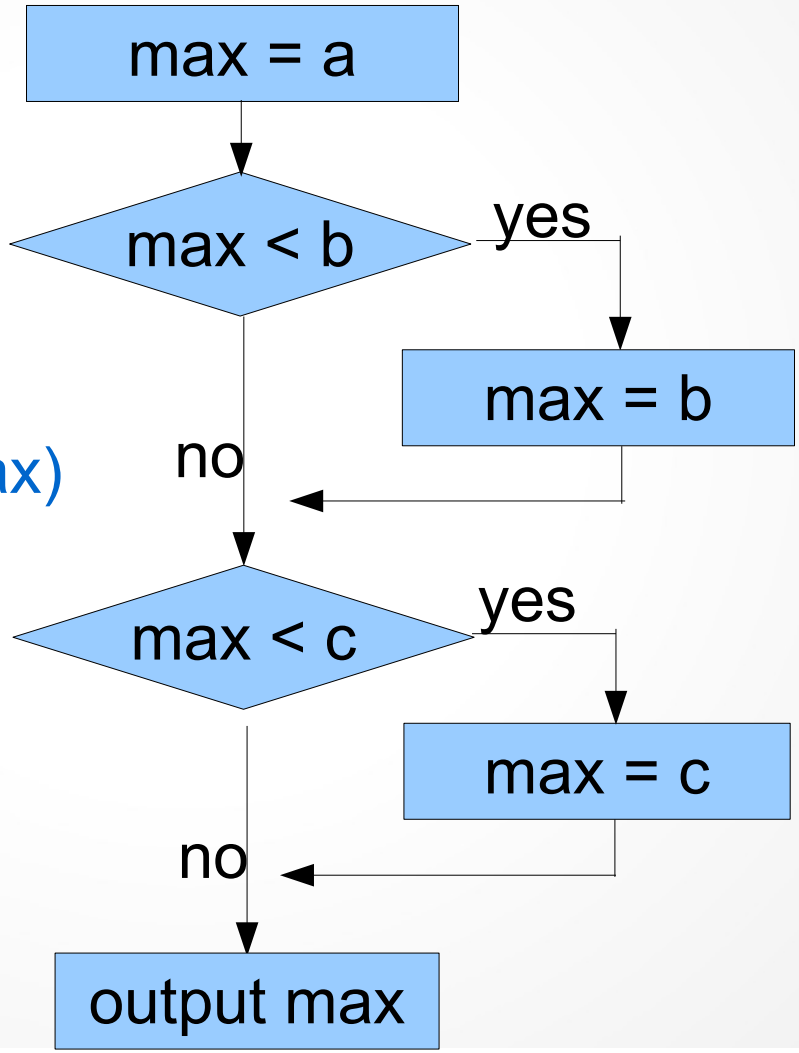



```
if a >= b:
    if a>= c:
        max = a
    else:
        max = c
else:
    if b >= c:
        max = b
    else:
        max = c

print("The maximum is", max)
```

7.5 Study in Design: Max of Three

3. Sequential Processing

```
max  = a
if b > max
     max = b
if c > max
     max = c

print("The maximum is", max)
```



7.5 Study in Design: Max of Three

4. Use already written by somebody function

Python's function:

```
max(a,b,c)
```

max() is a is a *built-in method* (does not need a special library) .