COMPUTER PROGRAMMING I
-3-

BIL2205

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The Problem Solving Sequence

1. Problemi anlama(Understanding, Analyzing)
2. Bir çözüm yolu geliştirme (Designing)
3. Algoritma ve program yazma (Writing)
4. Tekrar tekrar test etme (Reviewing)

Polya, George (1957)**'How To Solve It',**
Princeton University Press, 2nd Edition

Algorithm

Algorithm, named after the 9th century scholar Ebu Abdullah Muhammed bin Musa El-Harezmi.

"An algorithm is;

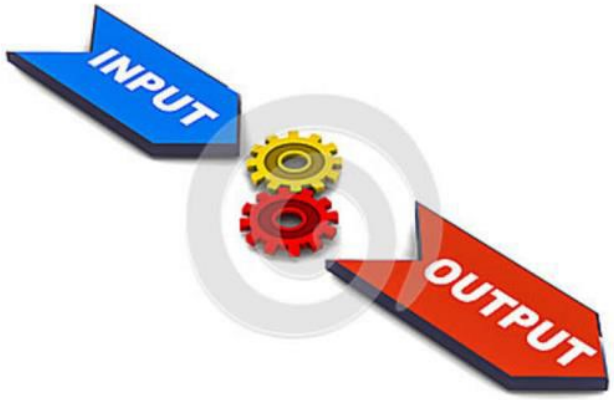
- any well-defined computational procedure that takes some value, or set of values, as input and produces some value, or set of values, as output.
- an algorithm is thus a sequence of computational steps that transform the input into the output."

Properties of an Algorithm

- Valid Input/Output (Geçerli Giriş, Çıkış)
- Finiteness (Sonluluk)
- Definiteness (Kesinlik, açıklık)
- Effectiveness (Etkinlik)

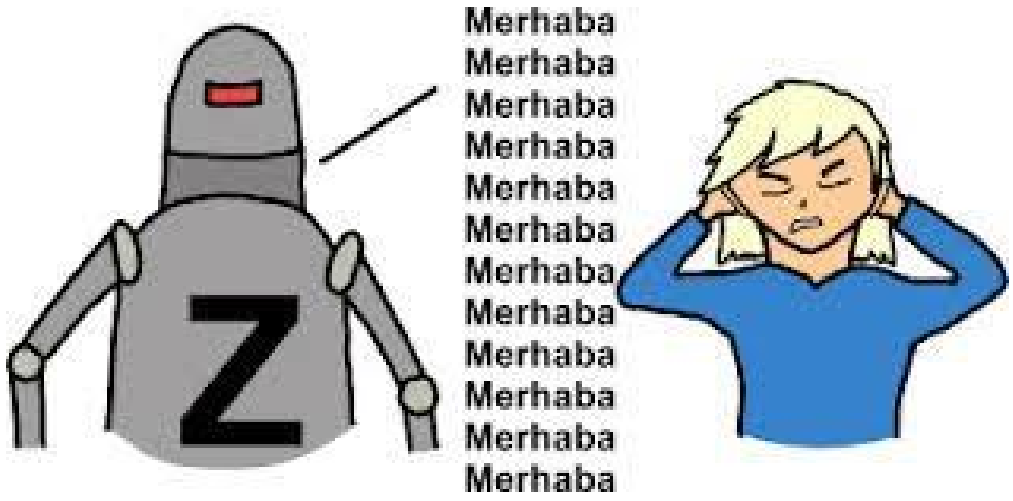
Valid Input/Output

- **Input:** An algorithm has zero or more inputs, taken from a specified set of objects.
- **Output:** An algorithm has one or more outputs, which have a specified relation to the inputs.



Finiteness (Sonluluk)

- The algorithm must always terminate after a finite number of steps.



Definiteness (Kesinlik, Açıklık)

- Each step must be precisely defined; the actions to be carried out must be rigorously and unambiguosly specified for each case.

Effectiveness

- All operation to be performed must be sufficiently basic that they can can be done exactly and in finite length.

Expressing Algorithms

- **Step form**
- **Pseude-code**
- **Flow charts**

Step Form

- This form of algorithm is the simplest and consists of a sequence of numbered steps or points.
- It is the easiest to learn at first since it is rather like a "to-do" list however once you have mastered other ways of stating algorithms you are unlikely to continue using this form.

Example: Make menemen for 1 person

1. START
2. Take 2 eggs
3. Take a spoon of margarine
4. Wash a tomatoe and cut into pieces
5. Wash a pepper and cut into slices
6. Put all in a saucepan
7. Burn the oven under the saucepan
8. Add some salt and black pepper
9. Until the desired stiffness is acquired
   - Stir all with a spoon
10. Turn off the oven
11. STOP.

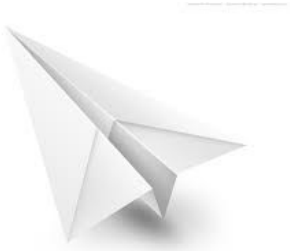
Example: Make a car move

1. START
2. Open the left front door with related key,
3. Sit on the driver's seat
4. Put the key in the keyplug
5. Adjust the driver's seat
6. Adjust the rearview mirror, left and right mirrors
7. Fasten the seat belt
8. Get the gear shift to neutral position in the middle
9. Put your left foot on the clutch pedal
10. Turn on the key until the engine starts
11. Get the gearshift to1 (upper left side)
12. Press on gas pedal with your right foot gently
13. Check the traffic by the mirrors
14. If is set, drop down hand brake
15. Slowly pull up your left foot from the clutch pedal
16. STOP.

Example: Make a tea

Where do you use algorithms in your life?

- Putting together IKEA furniture
- Looking up a word in the dictionary
- Folding paper airplanes
- Getting home from school
- Solving a jigsaw puzzle
- Solving a sudoku puzzle
- Solving rubik's cube



Pseudocode

Pseudocedo is a generic way of describing an algorithm without use of any programming language syntax.

Example: Write an algorithm for finding the sum of two numbers.

1. START
2. Read the first number
3. Read the second number
4. Find the sum of the two numbers
5. Print the sum of the numbers
6. STOP.

Example:

Step Form

1. START
2. Read the first number
3. Read the second number
4. Find the sum of the two numbers
5. Print the sum of the numbers
6. STOP.

Pseudocode

1. Start
2. Read X
3. Read Y
4. Sum←X+Y
5. Print Sum
6. STOP.

Example: Calculating the area of a triangle

1. START
2. Read the base
3. Read the height
4. Multiply the base by the height, and then divide by 2
5. Print the result
6. STOP.

Example:

Step Form

1. START
2. Read the base
3. Read the height
4. Multiply the base by the height, and then divide by 2
5. Print the result
6. STOP.

Pseudocode

b-base, h-height, area-A

1. START
2. Read b
3. Read h
4. A = (b *h)/2
5. Print A
6. STOP.

Example

Calculate the volume of a cylinder with given parameters

Step Form:

1. Read the radius (r) and the height (h) of the cylinder.
2. Calculate the volume.
   Volume=$\pi \times r^2 \times h$
3. Print out the volume.

Pseudo-code:

1. Read r, h
2. Volume=$\pi \times r^2 \times h$
3. Print volume.

Algorithms – Control Structures

- Condition Controlling
- Check if a given condition is TRUE of FALSE

IF (condition) THEN

    things to do if (condition) is TRUE

Algorithms – Control Structures

- Condition Controlling

IF (condition) THEN

things to do if (condition) is TRUE

1. START
2. READ yaş
3. IF (yaş > 50) THEN

   3.1 PRINT "Amma da yaşlıymışsın..."
4. END.

Algorithms – Control Structures

- Condition Controlling

1. START
2. READ yaş
3. IF (yaş > 50) THEN
   - 3.1 PRINT"Amma da yaşlıymışsın..."
   - 3.2 PRINT "Bir ayağın çukurda sayılır..."
   - 3.3 doğum_yılı ← 2019 – yaş
   - 3.4 PRINT doğum_yılı
4. END.

Algorithms – Control Structures

- Condition Controlling
- Check if a given condition is TRUE of FALSE

IF (condition) THEN

    things to do if (condition) is TRUE

ELSE

    things to do if (condition) is FALSE

Algorithms – Control Structures

- Condition Controlling

IF (condition) THEN

things to do if (condition) is TRUE

1. START
2. READ yaş
3. IF (yaş > 50) THEN

   3.1 PRINT "Amma da yaşlıymışsın..."

   ELSE

   3.2 PRINT "E daha genç sayılırsın..."
4. END.

Algorithms – Control Structures

Condition Controlling

1. START
2. READ yaş
3. IF (yaş > 50) THEN
   - 3.1 PRINT "Amma da yaşlıymışsın…"
   - 3.2 PRINT "Bir ayağın çukurda sayılır…"
   - 3.3 PRINT (2019 – yaş)

   ELSE
   - 3.4 PRINT "E daha genç sayılırsın"
   - 3.5 PRINT (2019 – yaş)
4. END.

Ex: Calculate the grade of a student with given midterm and final notes.

- Grade = Midterm x 40% + Final x 60%

1. START
2. READ midterm, final
3. grade = midterm x 0.4 + final x 0.6
4. IF (grade > 60) THEN
   - 3.1 PRINT "Wow… You passed the class."

   ELSE
   - 3.2 PRINT "Sorry you FAILED !!!"
5. END.

What if "grade = 60"????

Ex: Calculate the grade of a student with given midterm and final notes.

- Grade = Midterm x 40% + Final x 60%

1. START
2. READ midterm, final
3. grade = midterm x 0.4 + final x 0.6
4. IF (grade >= 60) THEN
   - 3.1 PRINT "Wow… You passed the class."

   ELSE
   - 3.2 PRINT "Sorry you FAILED !!!"
5. END.

Ex: Calculate "yaş" for a given "doğum_yılı". Comment as "genç", "orta-yaşlı" or "ihtiyar"

1. START
2. READ doğum_yılı
3. yaş = 2019 – doğum_yılı
4. IF (yaş < 25) THEN
   3.1 PRINT "Genç…"
   ELSE
   IF (yaş < 50) THEN
   3.2 PRINT "Orta Yaşlı…"
   ELSE
   3.3 PRINT "İhtiyar…"
5. END.

```
1. PRINT "Temperature of water? "
2. READ Temp
3. IF Temp <= 0 THEN
4.     PRINT "It's frozen"
5. ELSE IF Temp <= 12 THEN
6.     PRINT "It's cold"
7. ELSE IF Temp <= 25 THEN
8.     PRINT "It's warm"
9. ELSE IF Temp <= 75 THEN
10.    PRINT "It's hot"
11. ELSE IF Temp <= 100 THEN
12.    PRINT "It's very hot"
13. ELSE
14.    PRINT "It's burning"
15. END.
```

```
1. PRINT "Temperature of water? "
2. READ Temp
3. IF Temp <= 0 THEN                PRINT "It's frozen"
4. ELSE IF Temp <= 12 THEN          PRINT "It's cold"
5. ELSE IF Temp <= 25 THEN          PRINT "It's warm"
6. ELSE IF Temp <= 75 THEN          PRINT "It's hot"
7. ELSE IF Temp <= 100 THEN         PRINT "It's very hot"
8. ELSE                             PRINT "It's burning"
9. END.
```

Ex: Print the greatest of two given numbers

1. START
2. READ x, y
3. IF (x > y) THEN
   3.1 PRINT "X is greater than Y"
   ELSE
   3.2 PRINT "Y is greater than X"
4. END.

What if x = y ???

Ex: Print the greatest of two given numbers

1. START
2. READ x, y
3. IF (x = y) THEN
   3.1 PRINT "They are Equal"
   ELSE
   3.2 IF (x > y) THEN PRINT "X is greater than Y"
   3.3 ELSE PRINT "Y is greater than X"
4. END.

Ex: Calculate the grade of a student with given midterm and final notes.

- Grade = Midterm x 40% + Final x 60%

  - grade < 60 => " F "
  - 60 < grade < 70 => " D "
  - 70 < grade < 80 => " C "
  - 80 < grade < 90 => " B "
  - grade > 90 => " A "

Ex: Calculate the grade of a student with given midterm and final notes.

- Grade = Midterm x 40% + Final x 60%

1. START
2. READ midterm, final
3. grade = midterm x 0.4 + final x 0.6
4. IF (grade < 60) THEN PRINT " F "

4.1 ELSE IF (grade < 70) THEN PRINT " D "

4.1.1 ELSE IF (grade < 80) THEN PRINT " C "

4.1.1.1 ELSE IF (grade < 90) THEN PRINT " B "

4.1.1.1.1 ELSE PRINT " A "

5. END.