

Math 107 Lecture 8

Intro to Loops

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» Announcements and Objectives

Announcements

- * Skill Check 2 is on Wednesday (9/25, 60 mins then lecture)
- * Pre-Notes due before start of next lecture
- * Assignments Due Friday (9/27):
 - * HW4 Handwritten Questions
 - * HW4 Coding Problems
 - * HW4 MATLAB File Upload

Objectives

- * Create for and while loops in MATLAB
- * Use loops to access elements of vectors and matrices
- * Develop intuition for how to use loops to solve problems that require repeated steps

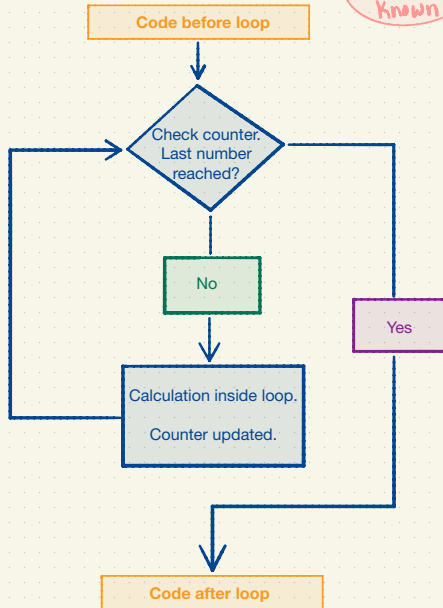
» for Loops

Structure

```
for loop_index = row_vector  
    (calculation)  
end
```

for loops

Use when # of iterations needed is known



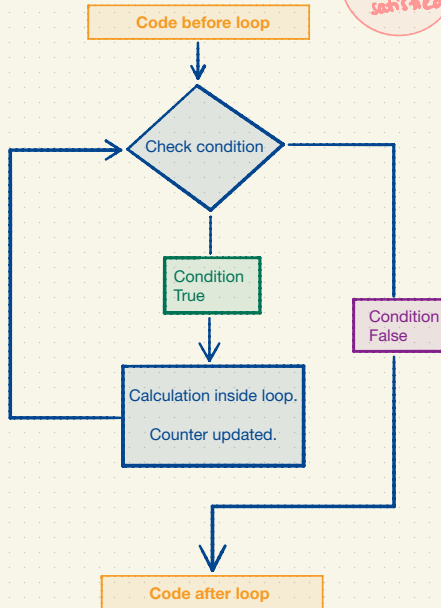
» while Loops

Structure

```
while (condition)
    (calculation)
end
```

while loops

Use when
condition
needs to be
satisfied



» for loop or while loop?

Use a **for loop** when:

- You know how many iterations are necessary
- The loop will run through a vector or matrix

Use a **while loop** when:

- You don't know how many iterations are necessary
- The loop will run until a condition is met

» Using mod ()

$b = \text{mod}(a, m)$ returns the remainder after division of a by m , where a is the dividend and m is the divisor.

Example: $\text{mod}(16, 7)$ returns 2

» Fibonacci Sequence (Need for HW5)

The Fibonacci sequence is a list of numbers where each number is created by adding the two before it. By starting with 1, 1, we get the sequence:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

Task: Write a loop that generates the first N Fibonacci numbers.

» Leap Year

Our calendar typically consists of 365 days. However, the time it takes for the earth to complete one full rotation around the sun is actually 365.25 days. To account for this, we have an extra day in our calendar every 4 years called a leap year. The requirements for a year to be a leap year are as follows:

1. The year must be divisible by 4.
2. If the year is divisible by 100 (e.g., 1700, 1800, etc.), the year must also be divisible by 400.

Some examples of leap years are 1600, 1712, and 2016. However, 1700 and 1800 are not leap years.

Task: Write a function called `leapYear` that takes as input the variable `year` and outputs the variable `msg`. The variable `msg` should contain either the string 'This is a leap year.' or 'This is not a leap year.' depending on the value of `year`. Test your function with the example years above (1600, 1712, 2016, 1700, 1800).

» Sum square difference (HW4)

The natural numbers are all the integers greater than 0. The sum of the squares of the first ten natural numbers is,

$$1 + 2^2 + 3^2 + \cdots + 10^2 = 385.$$

The square of the sum of the first ten natural numbers is,

$$(1 + 2 + 3 + \cdots + 10)^2 = 55^2 = 3025.$$

Hence the difference between the sum of the squares of the first ten natural numbers and the square of the sum is $3025 - 385 = 2650$.

Task: Write a program to find the difference between the sum of the squares and the square of the sum of the first N natural numbers. Test your code with $N = 10$ and then $N = 100$.