# Week 5 Tutorial 4

The purpose of this tutorial is walk you through a use-case for logical vectors and show you how they can improve your code. The goal of this tutorial is to create some random grades, and assign letter grades to them but using vectorized functions rather than for loops. The only for loop in this tutorial should be for the output which will be done for you.

```
% Always clear workspace variables before a new tutorial or program.
clear
clc
```

Edit the code below and update the variable named **name** with your name for this tutorial in the code below.

```
name="";
fprintf("Output for Tutorial_05_4 run by %s.\n", name)
```

## Input

Create a row vector of 50 random grade values with a normal distribution, a mean of 75, and a std dev of 15. Recall from previous tutorials that the formula for this is `mean + stddev*randn(nRows,nCols)`

Also, create an empty vector to hold the letter grades, normally you might use the `ones()` or `zeros()` functions but this won't work for characters. For characters you should use the `blanks(n)` function where `n` is the number of elements in the vector. `blanks()` does not have an option to make a multi-dimesional array like the other functions.

Finally, create a row vector of zeros which will hold the count of students receiving each letter grade (5 different grades).

```
numGrades =
letterGrades =
countByGrade =
```

## Manipulation

Assign a logical vector finding all grades with a value greater than or equal to 90. Then, using that logical array, assign the appropriate letter grade of 'A' to the `letterGrades` vector. Finally, capture a count of the students who received this letter grade.

```
% Logical vector of all grades >=90
gradeA =
% Assign the letter grade of A

% Assign the count of students getting As to the appropriate position in
% countByGrade
```

Repeat for B (>= 80 & < 90). Don't forget, you need the **full** condition statement for each condition you want to meet.

```
% Logical vector of all grades >=80 and <90
gradeB =
% Assign the letter grade of B

% Assign the count of students getting Bs to the appropriate position in
% countByGrade
```

Repeat for C (>= 70 & < 80)

```
% Logical vector of all grades >=70 and <80
gradeC =
% Assign the letter grade of C

% Assign the count of students getting Cs to the appropriate position in
% countByGrade
```

Repeat for D (>= 60 & < 70)

```
% Logical vector of all grades >=60 and <70
gradeD =
% Assign the letter grade of D

% Assign the count of students getting Ds to the appropriate position in
% countByGrade
```

Repeat for F (< 60)

```
% Logical vector of all grades <60
gradeF =
% Assign the letter grade of F

% Assign the count of students getting Fs to the appropriate position in
% countByGrade
```

## Output

```
% Print out the heading for the table of results
fprintf('Grade Report for ENR 261 Spring 2022\n\n')
fprintf('Student Number  Numerical Grade  Letter Grade\n')

% for loop to print each element in the NumGrades and LetterGrades vectors
for n = 1:1: length(numGrades)
    fprintf('    %2i\t\t%5.1f \t\t\t %s\n',n, numGrades(n), letterGrades(n))
end

% Summary statistics
```

```
% LetterChoices vector is used to efficiently use the for loop
GRADE_LETTERS = ['A' 'B' 'C' 'D' 'F'];

% Heading for summary statistics
fprintf('\nNumber Students Earning Each Letter Grade\n\n')
fprintf('Letter Grade  Number of Students\n')
% Prints the letter grade and the number of students earning that grade
for n = 1:5
    fprintf('\t%s\t\t%2i\n',GRADE_LETTERS(n), countByGrade(n))
end
% Total students is a good check to be sure that the sum of the letter
% grades earned is equal to 50
fprintf('\n%s \t\t %2i\n','Total Students', sum(countByGrade))
```

**Example output**

If you were to run your tutorial (enter **Tutorial_05_04** into the command window) your output should appear as follows. Keep in mind, these are random numbers so your values will be different

Output for Tutorial_05_4 run by Geoff Berl.
Grade Report for ENR 261 Spring 2022

| Student Number | Numerical Grade | Letter Grade |
|---|---|---|
| 1 | 84.3 | B |
| 2 | 48.3 | F |
| 3 | 83.6 | B |
| 4 | 63.5 | D |
| 5 | 61.7 | D |
| 6 | 54.5 | F |
| 7 | 62.0 | D |
| 8 | 55.9 | F |
| 9 | 60.8 | D |
| 10 | 92.0 | A |
| 11 | 71.5 | C |
| 12 | 58.4 | F |
| 13 | 92.0 | A |
| 14 | 83.4 | B |
| 15 | 80.0 | B |
| 16 | 66.1 | D |
| 17 | 84.4 | B |
| 18 | 64.6 | D |
| 19 | 62.5 | D |
| 20 | 65.2 | D |
| 21 | 67.5 | D |
| 22 | 82.2 | B |
| 23 | 87.9 | B |
| 24 | 44.4 | F |
| 25 | 67.5 | D |
| 26 | 52.7 | F |
| 27 | 92.5 | A |
| 28 | 98.5 | A |
| 29 | 64.7 | D |
| 30 | 87.5 | B |
| 31 | 82.8 | B |
| 32 | 80.3 | B |
| 33 | 88.3 | B |
| 34 | 85.8 | B |
| 35 | 78.1 | C |
| 36 | 63.6 | D |
| 37 | 97.3 | A |
| 38 | 59.6 | F |
| 39 | 73.4 | C |
| 40 | 69.6 | D |
| 41 | 89.9 | B |
| 42 | 92.7 | A |
| 43 | 94.3 | A |
| 44 | 96.0 | A |
| 45 | 53.7 | F |
| 46 | 80.4 | B |
| 47 | 75.1 | C |
| 48 | 65.5 | D |
| 49 | 77.7 | C |
| 50 | 70.3 | C |

Number Students Earning Each Letter Grade

| Letter Grade | Number of Students |
|---|---|
| A | 8 |
| B | 14 |

**Additional Notes:**

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