Nested Loops

A nested loop is a loop within a loop.

Ex: MATLAB code

```
colors = ["blue", "white", "red", "brown"];
things = ["egg", "liquid", "shirt"];

for x = colors
    display(x)
end
```

→ OUTPUT

"blue"
"white"
"red"
"brown"

```
colors = ["blue", "white", "red", "brown"];
things = ["egg", "liquid", "shirt"];

for x = colors
    for y = things
        display(x + " " + y)
    end
end
```

??? ...

OUTPUT:

x = "blue"
y = "egg" → "blue egg"
y = "liquid" → "blue liquid"
y = "shirt" → "blue shirt"
x = "white"
y = "egg" → "white egg"
y = "liquid" → "white liquid"
y = "shirt" → "white shirt"
x = "red"
y = "egg" → "red egg"
"red liquid"
"red shirt"
"brown egg"
"brown liquid"
"brown shirt".

"Alondra" + "Braulio" → "AlondraBraulio"
"Dustin" + " " + "Karina" → "Dustin Karina"

Ex: The nxn (augmented) Hilbert matrix is the matrix whose (j,k) entry is

$$H(j,k) = \frac{1}{j+k+\lambda}$$

where λ is some chosen constant called the augmentation parameter.

How can I write a program to make this matrix?

```
H = zeros(n,n)
for   j = 1:n
    for   k = 1:n
        H(j,k) = 1/(j+k+λ)
    end
end
```

row / column

$j=1$

$k=1$ $H(1,1) = \frac{1}{1+1+\lambda}$

$k=2$ $H(1,2) = \frac{1}{1+2+\lambda}$

$k=3$ $H(1,3) = \frac{1}{1+3+\lambda}$

$\vdots$

$k=n$ $H(1,n) = \frac{1}{1+n+\lambda}$

$j=2$

$k=1$ $H(2,1) = \frac{1}{2+1+\lambda}$

$k=2$ $H(2,2) = \frac{1}{2+2+\lambda}$

$\vdots$

$$\begin{bmatrix} \frac{1}{1+1+\lambda} & \frac{1}{1+2+\lambda} & \frac{1}{1+3+\lambda} & \cdots & \frac{1}{1+n+\lambda} \\ \frac{1}{2+1+\lambda} & \frac{1}{2+2+\lambda} & \frac{1}{2+3+\lambda} & \cdots & \frac{1}{2+n+\lambda} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \frac{1}{n+1+\lambda} & \frac{1}{n+2+\lambda} & \frac{1}{n+3+\lambda} & \cdots & \frac{1}{n+n+\lambda} \end{bmatrix}$$

Write some MATLAB code to make an 7×9 matrix whose (j,k) entry is $jk + j^2 + k^3$

```
for j = 1:7
  for k = 1:9
    A(j,k) = j*k + j^2 + k^3;
  end
end
```