

Submission Instruction: Please submit this homework on Canvas in a single pdf format. The filename should be "HWXX_FullName_RedID.pdf" (ex. HW01_JamesGault_12345678.pdf).
Please copy your Matlab code in the given box. Adjust the box size as needed.
Please also submit all your m files separately. **Don't zip them.**

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Converting Binary Numbers to Decimal Numbers

- Convert the binary number 1001001 to a decimal number. (point: / 5)

$$1001001 = 64 + 8 + 1 = 73$$

Converting Decimal Numbers to Binary Numbers

- Convert the decimal number 55 to a binary number. (/ 5)

$$55 = 32 + 16 + 4 + 2 + 1 = 110111$$

Variables in MATLAB

- What value will be assigned to the variables "x" and "y" at the end of this code? (/ 5)

```
x = 7;  
x = x+7;  
y = 2;  
y = y + 5;  
y = x + y;
```

$$x = 14, y = 21$$

- What value will be assigned to the variables "h", "g", and "f" at the end of this code? (/ 5)

```
h = 5;  
g = 20 - 2*h;  
f = 2*g - 2*h;  
f = f - h;
```

$$h = 5, g = 10, f = 5$$

Local vs. Global Variables

5. What will be the values of "x", "y", "a", "c", "d", and "e" be after running this code? (/ 5)

Function:

```
function [x, y, z] = myVariableTracker2 (a, b, c, d)
x = a + b + c;
y = x/d;
z = x + y;
end
```

Script:

```
% Using myVariableTracker2
b = 1;
c = 1;
d = 4;
e = 2;
[x, y, d] = myVariableTracker2(b, c, d, e);
```

X = 6, y = 3, b = 1, c = 1, d = 9, e = 2, a = Undefined

6. What will be the values of "a", "b", "c", "x", "y", and "z" be after running this code? (/ 5)

Function:

```
function [a, b, c] = myVariableTracker3(x, y, z)
a = x - y;
b = a + z;
c = a + b;
c = c + 2;
end
```

Script:

```
% Using myVariableTracker3
x = 1;
a = 2;
b = 3;
[a, x, y] = myVariableTracker3(x, a, b);
```

a = -1, b = 3, x = 2, y = 3, c = Undefined, z = Undefined

Numerical Expressions (Write your code in the box.)

7. A very powerful approximation for π was developed by a brilliant mathematician named Srinivasa Ramanujan. The approximation is the following:

$$\frac{1}{\pi} \approx \frac{2\sqrt{2}}{9801} \sum_{k=0}^N \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

Write a function with header [mypi] = myApproximationPI(N) to use Ramanujan's formula for N = 1 to approximate π . Be sure to use format long. Compare your approximation with MATLAB's stored value for pi. Hint: 0! = 1 by definition. Use MATLAB's **factorial** function. (/ 10)

Function:

```
function [mypi] = myApproximationPI(N)
format long
totalSum = 0;
for k = 0:N
    totalSum = totalSum + ((factorial(4*k))*(1103+26390*k))/(((factorial(k))^4)*(396^(4*k)));
end
mypi = ((2*sqrt(2)/9801)*totalSum)^(-1)
```

Script:

```
format long
N = 1;
myPi = myApproximationPI(N);
piDif = abs(myPi - pi);

fprintf("\nMy approximation of pi is: %.20f\n",myPi)
fprintf("Matlab's stored approximation of pi is: %.20f\n",pi)
fprintf("The difference between my approximation and Matlab's is: %.20f or %.5e\n\n",piDif,piDif)
```

Functions (Write your code in the box.)

8. Write a function with header [A] = myTriangle(b,h) where A is the area of a triangle with base, b, and height, h. Recall that the area of a triangle is one half the base times the height. You may assume that b and h are 1x1 doubles. (/ 15)

Test Cases:

```
>> a = myTriangle(1,1)
a= 0.5000
>> a = myTriangle(2,1)
a= 1
>> a = myTriangle(12,5)
a = 30
```

```
function [A] = myTriangle(b,h)
A = .5*b*h;
end
```

9. Write a function with header $[S,V] = \text{myCylinder}(r,h)$ where r and h are the radius and height of a cylinder, respectively, and S and V are the surface area and volume of the same cylinder. Recall that the surface area of a cylinder is $2\pi r^2 + 2\pi r h$, and the volume is $\pi r^2 h$. You may assume that r and h are 1×1 doubles. (/ 15)

Test Cases:

```
>> [S, V] = myCylinder(1, 5)
S = 37.6991
V = 15.7080
```

```
>> [S, V] = myCylinder(2, 3)
S = 62.8319
V = 37.6991
```

```
function [S,V] = myCylinder(r,h)
S = 2*pi*r^2 + 2*pi*r*h
V = pi*r^2*h
end
```

Branching (Write your code in the box.)

10. Write a function with header $[\text{tip}] = \text{myTipCalc}(\text{bill}, \text{party})$ where bill is the total cost of a meal and party is the number of people in the group. The tip should be calculated as 15% for a party strictly less than 6 people, 18% for a party strictly less than 8, 20% for a party less than 11, and 25% for a party 11 or bigger. (/ 15)

Test Cases:

```
>> t = myTipCalc(109.29,3)
t= 16.3935
>> t = myTipCalc(109.29,7)
t= 19.6722
>> t = myTipCalc(109.29,9)
t = 21.8580
>> t = myTipCalc(109.29,12)
t= 27.3225
```

```
function [tip] = myTipCalc(bill, party)
if ( party < 6)
    tip = .15*bill
elseif (party < 8)
    tip = .18*bill
elseif (party < 11)
    tip = .20*bill
else
    tip = .25*bill
end
```

11. Consider a triangle with vertices at (0,0), (1,0), and (0,1). Write a function with header
[S] = myInsideTriangle(x,y) where S is the string '**outside**' if the point (x,y) is outside of the triangle,
'border' if the point is exactly on the border of the triangle, and '**inside**' if the point is on the inside of
the triangle. (/ 15)

Test Cases:

```
>> S = myInsideTriangle (.5,.5)
S = border
>> S = myInsideTriangle (.25,.25)
S= inside
>> S = myInsideTriangle (5,5)
S = outside
```

```
function [S] = myInsideTriangle(x,y)
if (x + y == 1)
    S = 'border'
elseif (x + y < 1)
    S = 'inside'
elseif (x + y > 1)
    S = 'outside'
end
end
```