

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

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

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

Converting Decimal Numbers to Binary Numbers

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

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

Variables in MATLAB

3. 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;
```

$$x = 14, y = 21$$

4. 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 π . 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)end
```

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 1×1 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] = 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 `[tip] = myTipCalc(bill, 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
```