Q1. Convert the date 5/23/2020 to hex. Write in the form: M/DD/YYY

When converting decimal to hexadecimal, keep dividing the quotients by base 16 and reassemble the remainders as the digits of the resulting number:

Month: 5(10) = 5(16) Day: 23(10) = 23(10) / 16(10) = 1 R 7 = 17 (16)

2020 / 16 = 126 R 4, take 4
126 / 16 = 7 R 12, take 12(10) = E(16)
7 / 16 = 0 R 7, take 7

2020(10) = 7E4(16)

Answer: 5/17/7E4

Q2. Which number has the most 2's when converted to octal? 508(16) 88A(16) 195(16) 348A(16) 1050(16)

Step1. Convert each digit of the hexadecimal numbers into 4-digit binary groups
Step2. Re-group the binaries into 3-digit groups starting from the right (append leading zeros if it helps)
Step3. Convert each 3-digit binary group into an octal digit
Step4. Count the number 2's, and compare the counts

508	(16) = 0101 0000 1000	(2) = 010 100 001 000	(2) = 2 5 1 0	(8)	One 2
88A	(16) = 1000 1000 1010	(2) = 100 010 001 010	(2) = 4 2 1 2	(8)	Two 2's
195	(16) = 0001 1001 0101	(2) = 000 110 010 101	(2) = 0 6 2 5	(8)	One 2
348A	(16) = 0011 0100 1000 1010	(2) = 011 010 010 001 010	(2) = 3 2 2 1 2	(8)	Three 2's
1050	(16) = 0001 0000 0101 0000	(2) = 001 000 001 010 000	(2) = 1 0 1 2 0	(8)	One 2

If you believe you are better with binaries, you can count how many 010's in binaries are after step#2! 🙂

Answer: 348A

Q3. Find f(90) given: f(x) = 2 * f(x/3) - 1 if x is a multiple of 3 and odd
= -1 * f(x/2) + 2 if x is even
= x + 4 otherwise

f(90) = -1 * f(90/2) + 2 = -1 * f(45) + 2 = -1 * 33 + 2 = -31
f(45) = 2 * f(45/3) - 1 = 2 * f(15) - 1 = 2 * 17 - 1 = 33
f(15) = 2 * f(15/3) - 1 = 2 * f(5) - 1 = 2 * 9 - 1 = 17
f(5) = 5 + 4 = 9

Answer: -31

Q4. Find f(f(f(6))) given: f(x) = 2 * f(x-3) - 1 if x > 10
= f(x-3) + 3 if 2 <= x <= 10
= 3^x * x^3 if x < 2

Calculate from inside-out:
1) f(6); 2) f(f(6)); 3) f(f(f(6)))

f(6) = f(6-2) + 3 = f(4) + 3 = 6 + 3 = 9
f(4) = f(4-2) + 3 = f(2) + 3 = 3 + 3 = 6
f(2) = f(2-2) + 3 = f(0) + 3 = 0 + 3 = 3
f(0) = 3^0 * 0^3 = 0 f(6) = 9

f(f(6)) = f(9) = f(9-2) + 3 = f(7) + 3 = 12+ 3 = 15
f(7) = f(7-2) + 3 = f(5) + 3 = 9 + 3 = 12
f(5) = f(5-2) + 3 = f(3) + 3 = 6 + 3 = 9
f(3) = f(3-2) + 3 = f(1) + 3 = 3 + 3 = 6
f(1) = 3^1 * 1^3 = 3 * 1 = 3 f(f(6)) = 15

f(f(f(6)))= f(15) = 2 * f(15-3) - 1 = 2 * f(12) - 1 = 2 * 29 - 1 = **57**
f(12) = 2 * f(12-3) - 1 = 2 * f(9) - 1 = 2 * 15 - 1 = 29 f(9)=15 from Step#2

Answer: 57

Q5. What is outputted when this program is executed?

```
                                                    a     b     c     d     e
a = 12 : b = 6 : c = 3 : d = 2                      12    6     3     2
if a == b * d then                                                              12==6*2, true
e = a / b                                                                 2
end if
if b - d == a / c then                                                          6-2==4,12/3==4, true
e = e + a / c                                                             6     2+12/3==2+4==6
end if
e = a / c - e                                                             -2    12/3-6==4-6=-2
if b / c == a / e then                                                          pos != neg, false
a = 2 * d
else
a = 2 * e                                           -4    6     3     2     -2
end if
if (a < b) || (c < d) then                                                      a<b, true
a = a + b                                           2                           -4+6==2
else
c = c + d                                           2     6     5     2     -2    3+2==5
end if                                                                          (2<6) && (6+5>5*5),
if (a < d) && (b + c > c * c) then                                              11>25,false
d = a + c
else
c = d - b                                           2     6     -4    2     -2    d-b==2-6==-4
end if                                                                             6/2+(-4)*(-2)/(2+6)-(6+2)/2*2
x = b / a + c * e / (d + b) - (b + d) / a * a                                      =3+8/8-8/2*2=3+1-8=4-8=-4
print x
end
```

Answer: -4