9/17/18 NOTES MA 330

Two Residue Problems:
n=ax+r
n=by+s
ax-by+r-s=0
OR: ax-by=c, c=r-s

No Residue Problems:
solve ax-by=d   d=gcd(a,b)

For any c=md solve

Always want the general solution

Practice Problem 1:
n+2=29x   n=29x-2 -2=r
n-7=45y   n=45y+7   7=s s-r=9
29x-45y=9

126	45	
81	29	1
45	16	1
36	13	1
9	3	4
0	1	3
9	0	

-45t -29t
126(29)-81(45)=9
36(29)-23(45)=9
29x-45y=9

36=x 23=y

n=29(36)-2=1042=45(23)+7

n=1042+m1305
lcm(29,45)

Practice Problem 3:
$n \equiv 5\ mod\ 8$ 9-8=1
$n \equiv 4\ mod\ 9$ 1(9)-1(8)=1
$n \equiv 1\ mod\ 7$

N=5+8x   9y-8x=1   n=13
N=4+9y   x=1 y=1

General n=13+n(72)

$n \equiv 13\ mod\ 72$
$n \equiv 1\ mod\ 7$

0=-12+7y-72x
12=7y-72x
12=7(12)-72(1)
N=13+72=85

31	72	
3	7	10
1	2	3
0	1	2
1	0	

31(7)-3(72)=1
372(7)-36(72)=12
-72t   -7t   t=5
12(7)-72(1)=12

Practice Problem 4:

$n \equiv 1 \; mod \; 2$	Let n-1=m
$n \equiv 1 \; mod \; 3$	M is divisible by 2, 3, 4, 5, 6
$n \equiv 1 \; mod \; 4$	Lcm(2, 3, 4, 5, 6)=60
$n \equiv 1 \; mod \; 5$	M=60t
$n \equiv 1 \; mod \; 6$	N=1+60t =7s
$n \equiv 0 \; mod \; 7$	7s-60t=1

Practice Problem 5:

Same as 4 except lcm(2, 3, 4, 5, 6, 7, 8, 9)
=Lcm(60*7*2*3)
=lcm(360*7)=2520

Problem 6 (Revised):

$n \equiv 2 \; mod \; 3$
$n \equiv 3 \; mod \; 5$
$n \equiv 5 \; mod \; 7$

Find a multiple of 3(5)=15 which is 1 mod 7. “15” works
Find a multiple of 5(7)=35 which is 1 mod 3. “70” works
Find a multiple of 7(3)=21 which is 1 mod 5. “21” works

CLAIM:
15*5+21*3+70*2 is an answer.
This works because divided by 3 we get 2, divided by 5 we get 3, and divided by 7 we get 5.