## Assignment 4

COMP232 SECTION (PP)

Mustafa Alawadi (40217764)

Presented to Professor Hassan Hajjdiab

Due December 1, 2023

I certify that this submission is my original work and meets the Faculty's Expectations of Originality.

Mustafa Alawadi

Date: November 28

	The	additi	on tab	le for	26:		-5
+6	0	1	2	3	4	5	26= {0,1,2,3,4,5}
0	0	1	2	3	4	2	
1	1	2	3	4	5	0	
12	2	3	4	5	0	1	
3	3	4	5	0	1	2	
14	4	5	0	1	5	3	
5	5	0	11	2	3	1 4	
-							

The cells in the table represent the result of adding the raws and columns elements modulo 6.

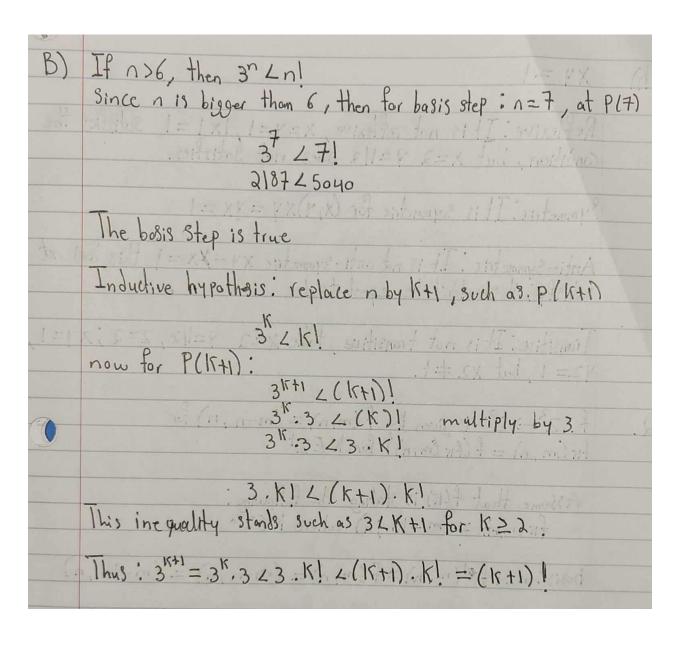
The multiplication table for 26:

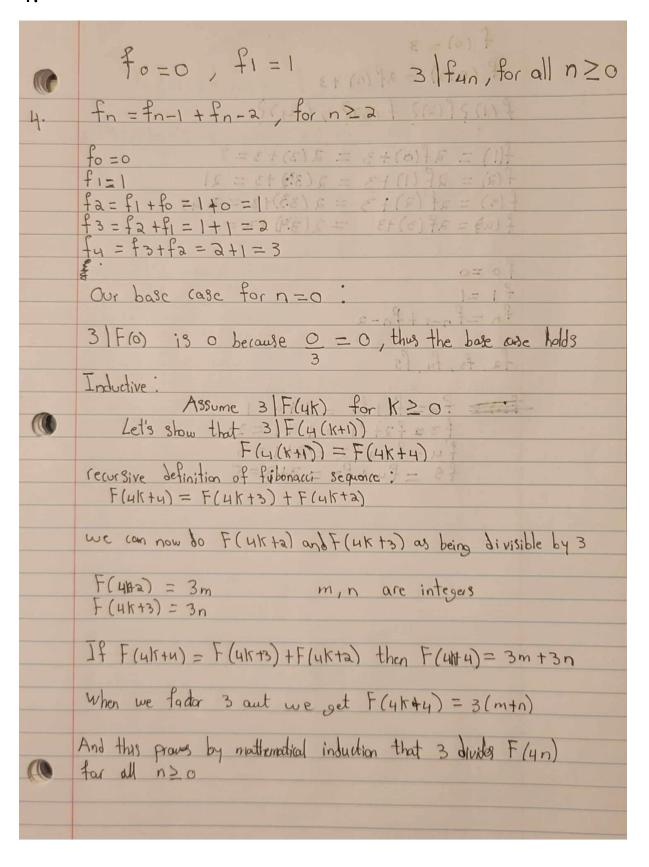
		and the second	_				
1	X6	0	1	2	3	4	5
ì	0	0	0	0	0	0	0
i	1	0	1	2	3	9	5
i	2	0	2	4	0	2	4
1	3	0	3	0	3	0	3
	u	0	14	2	0	4	2
-	5	0	5	4	1 3	2	1
	1	_			1	1	

The cells in the table represent the result of multiplying the rows and columns elements of 6.

2.	$f: \mathbb{Z}^2 \to \mathbb{Z}^2$ is given by $f(m,n) = (m-n,n)$ for $f(m,n) = f(f(m,n))$ for $f(m,n) = f(f(m,n))$ for $f(m,n) = f(m-n,n)$
	Assume that $f(K)$ is stating the following: $f(K) = (M - Kn, n)$ where $K \in \mathbb{Z}^2$
	Bosis: n=1 f*1(m,n)=f(m,n)=(m-n,n)=(m-1n,n)
3	Inductive Hypothesis: n=t. Assume fr (m,n) = (m-Irn,n)
	Inductive step: n=1r+1
	$f(f^{KH}(m,n)) \text{ inductive } S \text{ tep hypothesis}$ $f(m-Kn,n)$ $(m-Kn-n,n)$ $(m-(KH)n,n)$

A) $1 \times 11 + 2 \times 21 + \dots + n \times n1 = (n+1)! - 1$
Checking for the base case: P(n)
X ! = ( + )! -
=
Inductive hypothesis:
$ x _{1} + 3x =  x _{2} + \dots +  x _{2} = ( x _{2}) _{1} - 1$
X   ! † 2 X 2 ! T T K X K ! - ( K K ! ) ;
Thus for P(K+1)
TO THE TENED TO TH
[cft side:  x   + x x z  + 3x 3  + ··· + K x K  + (k+1) x (K+1)
Right Side: (K+1)!-1+(K+1)! x (K+1) = (K+1)! x (K+1+1)-1
$=(k+1)i \times (k+2)-1 = (k+2)i-1$
Therefore, 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
X   + 2 X 2   + 3 X 3   + + V X V   + ( W 1 )   -
In conclusion, this is true for all n E 2+.
the state of the second by the second by



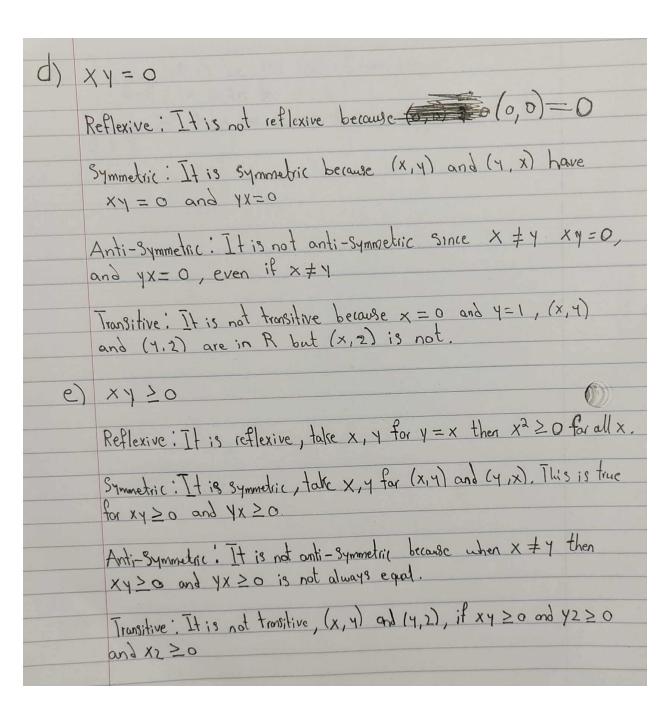


5.	Bosic step: n=18 since n≥18
	P(18) is true since two 7-cents and one 4-cents stamps can be used to get an 18 cents. Ex: $(2x7)+4=18$
	Strong Inductive Hypothesis:
	The statement holds for $18 \le n \le K$ . Therefore, $18 \le n \le K$ can be Produced using yearts and 7 cents stamps. Also, if we let $K \ge al$
9	P(18), P(19), P(20), P(21)P(K+1)
	If we know that K-3 can be produced that using 4 and 7 cents stomps, thus, to form K+1 cents, we can add a 4 cents stomp to the K-3 cents.
	We conclude that P(K+1) is true Since K-3 can be represented by 4 conts and 7 conts, thus K+1 can also be represented.

7.71	
6.A)	S={(a,b): a:EZt, b:EZt, and a 16} (8
	This relation can be described for positive integers a and b, a
	divided by b gives an integer. $+816 = (7)9$
	Bose cose: (n,n) ES for any positive integer n. This states that any positive integer is simisible by 1.
rd 6008	Recorgive cose: Using a and bill (a, b) E3 then (a, bk) E3  And enimalithms)  17. E. S. E. for all K E 2+
1	31°+1 L 3.K1
p)	This relation can be described for positive integers a and b, the sum of a and b divided by 3 will give an integer, in other words:
	$\exists m = (a+b)$ $\exists x : a=1 \text{ and } b=2 \text{ or } a=2 \text{ and } b=1 \text{ i will end such } a) = 3, divisible by 3 \exists x : a=2 \text{ and } b=11 \text{ or } a=4 \text{ and } b=2 \text{ i will end such } a=6 \text{ divisible by } 3$
	((1+71) \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
0: (-)	Ex. a=1 and b=2 or a=2 and b=1; will end such as = 3, divisible by 3
Fx.	Ex: a=2 and b=4 or a=4 and b=2; will end such as =6, divisible by \$3 (a=4 and b=5) or (a=5 and b=4); will end such as a+b=9, divisible by 3
CAI	The same of the sa
	Recursive cose: Using a and b
	Do I need to menore Sti
	$(a,b)ES \Longrightarrow (a+3,b)ES$
	(a,b)E3 =>(a,b+3)E3
	$(a,b) \in 3 = > (a+1,b+2) \in 3$
	(a,b)ES = > (a+2,b+1)ES

7. A) X+ 24=0 : 25 not aldet notibbe ad	
Reflexive! It is not reflexive because if x=1, the	n Ita(1) is
not equal to 0. 8 14 E 10	0
1 2 3 4 5 0	1
Symmetric: It is not symmetric because if x = 2 and y=-	-1 then
2+2(-1) = 0, however, -1+2(2) is not equal to 0.	18
N 5 0 1 2 3	P
Anti-Symmetric: It is indeed onli-Symmetric because when	we swap
x and y and negate the whole expression, it becomes - (	Ytax) which
one is not equal to the original expression.	not I
mas closents movels 6.	ilas
Transitive: It is not transitive, take the cole: (x+24)	)+ (Y+22)
B) v = 2v	
B) $x = ay$	
Reflexive: It is not reflexive since x=1, 1 = 20	11
A STATE X-1, 1+ at	l xx
Symmetric: It is not symmetric x=6 and q= 20 6=	2(3)   200000
2 + 2 (3) 2 1 2 5 5 1 0	1 Navely
H 8 0 H 8 0	8
Anti-Symmetric. It is anti-Symmetric X=ay, Y=ax as	long as X= Y
6 H 0 6 N 0	NI
Transitive: It is not transitive, take cose: (x+ay)+	(Y+22) 6
	G

()	X-y is a rational number provided and	F
	Reflexive: It is reflexive X-Y for X=Y, X-Y=0	(A
		1 6
	Symmetric: It is symmetric (a, b) or (b, a) as if x = y is ratio	anal,
	then - (x-y)= y-x	
	1-(1+1)=!/X!	1100
	Anti-Symmetric: It is not onti-Symmetric (a,b) since a is \$76 orls stands for (b,a) : 2100 Atogral suitable	, This (
	also stands for (b, a) : 2180 Atogral svitumbal	
	Transitive: It is transitive, take cose when $x = y = \frac{\alpha}{2}$ or	nd 4-2= C
	and x-7 = C = 9	9
	Thus for P(K+1) d .C	
	1/2 = 175 - 176 + 177 C	0
(X+)	x (1+x) + 1xx + + + 18x8 + 10x 6+ 11x1 ol 8 + 1-3	



-	
f)	X=1 or y=1
().=	Reflexive: It is not reflexive, 3 ER, but not in 3R3.
974	Symmetric. It is symmetric take x=1 or y=1, y=1 or x=1; y & x
	Anti-Symmetric. It is not anti-symmetric take x = 1 and y = 5+> 1=5
O = 6 Y	Minti-Symmetric. It is not anti-symmetric talle x = 1 and y = 5 +> 1=5
19 - 1 -	Transitive: It is not transitive take 2R land 1R5+>2R5.
	pending of the the thought of the article of the same article of t
8)	X is a multiple of yours of sufficient for en 47 : sufficient
	Reflexive: It is reflexive as every element of x is a multiple of
	Reflexive. It is reflexive as every element of x is a multiple of
	Itself.
.1	Symmetric: It is not symmetric, counter example: X = 4, y=2.
100	X = 24 note that wis not a multiple of x has so 2 is not enough to
	x = 2y, note that y is not a multiple of x because 2 is not equal to any integer multiple of 4.
	os xx lac os xx va
	Anti-Symmetric: It is anti-symmetric because x +y then x y and yx
ASS	Cannot both be true.
	Truestine: The tenestine like in the KAZ of the in 702 mas
020	Transitive: It is tensitive, take $x = ky$ , $K \in \mathbb{Z}$ also take $y = n2$ , $n \in \mathbb{Z}$

Reflexive: It is not reflexive, x=y=1, |x|=1 satisfies the condition, but  $x=\lambda$   $y=1/\lambda$  does not satisfies.

Symmetric: It is symmetric for (x,y)xy=yx=1Anti-symmetric: It is not anti-symmetric xy=yx=1 this does not satisfy, it shouldn't be equal to 1.

Transitive: It is not transitive, take  $x=\lambda$ ,  $y=1/\lambda$ ,  $z=\lambda$ ; xy=1, yz=1, but xz=1.

8. A)	If we let A be the set of even integers
	A= {xEZ x = an for n EZ}
	If we let B be the Sct of odd Integers
A	$B = \{x \in 2 \mid x = an + 1 \text{ for } n \in 2\}$
	The condition for partitions stand for both A and B because every
	integers are either odd or even, but not both.
BI	The set of interes divisible by 3 the set of interes leaving a
	The set of integers divisible by 3, the set of integers leaving a remainder of I when divided by 3, and the set of integers leaving a
	remainder of a whon divided by 3.
	Let A be the set of integers divisible by 3: A + 2: A: ?9, -6, -3
	Let B be the set of integers leaving a remainder of 1 3,6,9 }
	when divided by 3: BEZ: B: {8, -5, -2, 1, 4, 7, 10}
	Let C be the set of integers leaving a remainder of 2 when divided by 3:
	CEZ: C: {10,-7,-4,-1,2,5,8,11,}
	Because all sets A, B and C are the disjoint sets and the union of
	3 sets makes the complete sets of integers. Then we can conclude that the set of integers leaving a remainder of I when divided by 3
	and the set of integers leaving a remainder of 2 when divided by 3
	are all the partitions of the set of integers 2.
1, 1, 1, 1	

C) Let A be the set of integers 1838 than - loo: A & 2:

A: \{..., -loy, -lo3, -lo2, ...\}; A = \{x \in z \leq x \in z \leq x \in -loo\}\}

Let B be the set of integers with absolute value not exceeding loo:

B = \{x \in z \leq z \leq x \in z \leq z \leq x \in z \in z \leq x \in z \in z