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	Math 61 HW # 2
* 1	When NZI, For all a, b, c & Z
	$i)$ $\alpha = \alpha \pmod{n}$
	ii) if a = b(mod n) then b = a(mod n)
	iii) if a = b (mod n) then b = c (mod n) then a = c (mod n)
	In this case, n=5. 521
	This means that congruence modulo 5 is an equivalence
	relation on Z because it is reflexive, symmetric, and transitive.
	There will be 5 different equivalence classes:
	[0]: {, -5, 0, 5, 10, 15,}
	[1]: {, -4, 1, 6, 11, 16,}
	[2]; {, -3, 2, 7, 12, 17,}
	[3]: {, -2, 3, 8, 13, 18,}
	[4]: {, -1, 4, 9, 14, 19, }
. 2.	X is a Set P: collection of subsets of X
	- This is basically what the definition of partition of a
	set" entails. In class we found that:
	OUB-X BEP
	@ B N B' = \$ for any B, B' & P' while B # B'
	These conditions must hold for P to be a partition because
	1 Blocks have to be within P, which are in tuin within X
	There shouldn't be equivalent blocks within a partition anyway.
	The intersection of two completely different blocks would
	dlways be an empty set because they share nothing in common.
₩ 3.	
	Define [x] = {y Ex: y Rx} -> This is the formal definition
10-7 X	of an equivalence class when R is an equivalence relation on set X.
	. P = {[x]: x ∈ X} is a partition of X because the
	distinct set of equivalence classes of R forms a partition of X.
	Must show that every element in X belongs to exactly one member of P
	Let x EX. Since x Rx, x \(\int \int \x \). This every element in X belongs to
	at least one member of S. Now must show that every element in
	x belongs to exactly one member of S. q. if x \in X and x \in [a] \cap [b], then [a] = [b]
	d. 14 XEV and X Erallippi, Then I'm [m]

Show that for all c, d \(\) x \(\) x \(\) c \(\) R \(\) then \(\) \(\) = \(\) \(\) Suppose \\ \(\)		
CRd. Let X e[c]. Then x R c. Because c Rd and R In Fransitive, x Rd. This means x e [d] and [c] \(\) [d]. Using the same logic, the claim [d] \(\) [c] \(\) [is true as well (just interchange roles of c and d). Now assume that x \(\) x \(\) and x \(\) [a] \(\) [b]. Then x \(\) a and x \(\) b \(\) All if this proof and statements combined s how that \(\) cx = [a] and \(\) x = [b]. Thus, \(\) [a] = [b] and \(\) P is, a partition of x. * This theorem and its inverse are known as the Fundamental Theorem on equivalence relations. 4. This is the inverse in \(\) \$\frac{1}{2}\$. X is a set with partition \(\) \(
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Is transitive, & Rd. This means & E[d] and [c] & [d]. Using the same logic, the claim [d] c [c] is true as well (just interchange roles of c and d). Now assume that & & X and & E[a] \(\text{Lb} \), Then & Ra and & Rb. All if this proof and statements (ambined show that [x] = [a] and [x] = [b]. Thus, [a] = [b] and P is a partition of X. * This theorem and its inverse are known as the fundamental Theorem on equivalence relations. 4. This is the inverse in #3. X is a set with partition P = \(\text{E} \), \(\text{X}_2, \text{X}_2, \text{X}_3		
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Y C X: A X G X : X RX by Los S C 1 2 2 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2		- 1
X ∈ X; A x ∈ X; x Rx by def, of relation induced by partitions	sus /	19
Ris symmetric		140000000000000000000000000000000000000
Let x Ry. Fi (X \in Y \in X;) by def, of relation induced by		
a partition. Because y EX; 1 x EX; y Rx, V		
Ris Transitive		
Suppose x Ry 1/Rz.		2.2.
Fi (x e X; n y e X;) and Fi (y e X; n z e X;)		2 2 2
The sets are pair wise disjoint either X: = X; or X: \X; = B		
y is on both these sets, Xin X; # Ø, so Xi=X;		
X and z are both in the same set, so x Rz /	> 10 0	-
These statements showing that R is reflexive, symmetric, and transitive	sitire	
prove that R is an equivalence relation on X.		

3	
5.	R be a relation on a set X
	$[x] = \{ y \in X \mid y \in X \}$
	Arbitrary relations (eg. nonequivalence relations) will
	not yield a partition of x because of the Fundamental
	Theorem on Equivalence Relations. This theorem states
	that for equivalence relations, the sets (x) would give
	a partition of X.
	In this case of arbitrary relations, we can assume the
	relations are not reflexive, symmetric, and transitive.
	This disqualifies them from being equivalence relations
	and then the theorem on equivalence relations won't
	apply to them. Therefore, the sets do not necessarily
	give a partition of X.
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