FIRST:		LAST:										
Discussion:	Monday	9	10	11	12	1	2	3	4	5		
1. (5 points) How	many different					ma	de be	rearr	angin	g th	e characters	in th
	ere are 13 lette					of s,	two 1	z's, ar	nd 2	a's.	So the num	ıber c
					13! !2!2!							
2. (10 points) Che	eck the (single)	box	that be	est cha	aracteriz	zes e	each it	em.				
exactly 5 color	oh with 12 verties. By the pige on at least two	eonho	le prin				true		f	alse	$\sqrt{}$	
$f: \mathbb{N} \to \mathbb{R}, \ f(x)$	$x) = x^2 + 2$		onto not a	valid	function	n [		no	ot ont	О	$\sqrt{}$	
$f: \mathbb{N}^2 \to \mathbb{N}, \ f($	(p,q) = pq		onto not a	valid	function	n [	$\sqrt{}$	n	ot on	to		
$g: \mathbb{R}^2 \to \mathbb{R}^2, g$	(x,y) = (y,3x)		one-t		function	n [	$\sqrt{}$	n	ot on	e-to-	one	
$\exists y \in \mathbb{Z}, \ \forall x \in \mathbb{Z}$	$\mathbb{Z}, \ y \leq x$		true		fal	se	\/					

Examlet 5, Part B

Discussion:

Monday

9 **10**  11

12

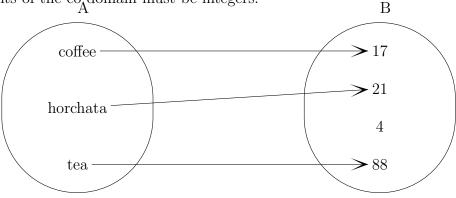
1

 $\mathbf{2}$ 3 4

5

1. (5 points) Complete this picture to make an example of a function that is one-to-one but not onto, by adding elements to the co-domain and arrows showing how input values map to output values.

The elements of the  $\operatorname{co}_{\bar{\Lambda}}$  domain must be integers.



2. (10 points) Check the (single) box that best characterizes each item.

If a function from  $\mathbb{R}$  to  $\mathbb{R}$  is increasing, it must be one-to-one.

true

false



 $f: \mathbb{Z} \to \mathbb{Z}, f(x) = x + 3 \text{ if } x \text{ is even,}$ and f(x) = x - 22 if x is odd

onto

not a valid function

not onto



 $g: \mathbb{Z} \to \mathbb{Z}, \ g(x) = 7 - \left| \frac{x}{3} \right|$ 

onto

not a valid function

not a valid function

not onto

 $q: \mathbb{Z} \to \mathbb{Z}, \ q(x) = |x|$ 

one-to-one

not one-to-one



 $\exists y \in \mathbb{N}, \ \forall x \in \mathbb{N}, \ x = xy$ 

true

false

CS 173, Sp Examlet 5,	•	NETID:					
FIRST:			LAST	·:			
Discussion:	Monday	9 10 1	1 12	1 2	3	4	5
1. (5 points) Support are there from a Solution: $q^p$		p and $ B  = q$ .	How many	differei	nt func	etions	
2. (10 points) Che	ck the (single)	box that best c	haracterize	es each i	tem.		
Suppose a graph exactly 5 colors color appears of	s. By the pige	onhole principle		true		fa	lse 🗸
$f: \mathbb{N} \to \mathbb{R}, \ f(x)$	$)=x^2+2$	onto not a vali	d function		nc	ot onto	
$f: \mathbb{N}^2 \to \mathbb{N}, \ f(g)$	p,q) = pq	onto not a vali	d function	$\sqrt{}$	no	ot onte	э 🗌
$g: \mathbb{R}^2 \to \mathbb{R}^2, \ g(g)$	(x,y) = (y,3x)	one-to-on not a vali	e d function	$\sqrt{}$	no	ot one	-to-one

true

false  $\sqrt{\phantom{a}}$ 

 $\exists y \in \mathbb{Z}, \ \forall x \in \mathbb{Z}, \ y \leq x$ 

CS 173, S <sub>I</sub> Examlet 5	_	N	ETII	D:									
FIRST:					LAST	Γ:							
Discussion:	Monday	9	10	11	12	1	2	3	4	5			
1. (5 points) How word 'minim	many different			_	can be	mad	e be ı	rearra	angin	g the	charact	ters i	n  heta
Solution: The number of perm	ere are 10 chara nutations is	cters	total,	with	two cop	ies o	f m a	nd th	ree c	opies	of i. So	the	tota
					$\frac{10!}{3!2!}$								
2. (10 points) Ch	eck the (single)	box	that be	est ch	aracteriz	zes ea	ach ite	em.					
•	a function such the set of all e		t		e domain		v	/	the	e co-do	omain o	of $f$	
$g: \mathbb{Z} \to \mathbb{N}, \ g(x)$	=  x		onto not a	valid	function	n _	√ 	no	ot on	to			
$f: \mathbb{N} \to \mathbb{N}, f(x)$	c) = 3 - x		one-to-		function	n _	<u>√</u>	no	ot one	e-to-or	ie		
$f: \mathbb{Z} \to \mathbb{Z}, f(x)$ and $f(x) = x$	x(x) = x + 3  if  x  is  x + 22  if  x  is odd	s ever	1,		e-to-one t a valid	func	etion			not o	ne-to-o	one	√
$\exists y \in \mathbb{R}^+, \ \forall x \in (\mathbb{R}^+ \text{ is the position})$	$\mathbb{R}^+, xy = 1$ tive real number	ers.)	t	rue		fals	se -	$\checkmark$					

CS 173, Sp Examlet 5	_	5 N	ETID	):							
FIRST:					LAST	Γ:					
Discussion:	Monday	9	10	11	12	1	2	3	4	5	
1. (5 points) Support there from A to		p and	d B  =	q, p	$0 \le q$ . H	ow n	nany	differ	ent c	one-to-o	ne functions are
Solution: $\frac{q!}{(q-p)}$	<u>)!</u>										
2. (10 points) Che	eck the (single)	box t	hat bes	st ch	aracteriz	zes ea	ach it	em.			
A function is o image is the same			tri	ue	$\sqrt{}$	fals	e				
$f: \mathbb{Z} \to \mathbb{R}, \ f(x)$	x(x) = x		one-to-		function	n _	$\sqrt{}$	n	ot on	e-to-one	е
$g: \mathbb{Z} \to \mathbb{Z}, \ g(x)$	$0 = 7 - \left\lfloor \frac{x}{3} \right\rfloor$		one-to-		function	n [		no	ot one	e-to-one	$\sim$
$f: \mathbb{N}^2 \to \mathbb{Z}, \ f($	$(p,q) = 2^p 3^q$		onto not a v	valid	function	n [		no	ot ont	50	]

false

 $\forall x \in \mathbb{Z}, \ \exists y \in \mathbb{Z}, \ x \neq y \text{ and } x + y = 0$  true

CS 173, Spr Examlet 5, l	_	NETID	:				
FIRST:			LAS	T:			
Discussion:	Monday	9 10	11 12	1 2	3 4	1 5	
1. (5 points) Suppos to $B \times C$ ?	e that $ A  = p$	,  B  = q,  C	C =n. How	w many di	fferent fu	inctions are	e there from $A$
Solution: There $B \times C$ .	are $qn$ element	is in $B \times C$ .	. So there a	are $(qn)^p$ v	vays to b	uild a func	tion from A to
2. (10 points) Check	the (single) b	ox that best	t characteri	zes each i	tem.		
If $f: A \to B$ is or	nto, then	$ A  \ge  B $	$\sqrt{}$	$ A  \le  B $		A  =  B	?  <u> </u>
$f: \mathbb{R} \to \mathbb{Z}, \ f(x) =$	= <i>x</i>	one-to- not a v	one alid functic	on $\sqrt{}$	not (	one-to-one	
$g: \mathbb{N} \to \mathbb{Z}, \ g(x) =$	$=x^2$	one-to- not a v	one alid functio	on _	$\operatorname{not}$	one-to-one	
$g: \mathbb{Z} \to \mathbb{N}, \ g(x) =$	: x	onto not a v	alid functic	on $\sqrt{}$	not o	onto	

true

false

 $\forall x \in \mathbb{R}^+, \ \exists y \in \mathbb{R}^+, \ xy = 1$  ( $\mathbb{R}^+$  is the positive real numbers.)