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Department of Computer Science and Engineering
Data Science

Semester: DSGT Academic Year: 2022-2023
ex If ACB when P(A) c P(B).
=> Let cep(A) Then c cA which implies CEB
CEP(B)
p(A) c P(B)
* Functions :-
Definition - Let A and B be non-empty sets A
function of from A to B, denoted as
f: A > B, is a relation from A to B such
b & B such that (a, b) & f.
Normally if (a,b) Ef, we write f(a)=b.
Property of function:
If f(a) = b and f(a) = c
then b=C
This condition emplies that to each element
a EA, a unique element bEB should be
assigned by the relation f.
As f is a relation we may also express
fas a set of ordered pairs, i.e.
fas a set of ordered pairs, i.e. f = {(a, f(a)) a ∈ A, f(a) ∈ B }
domain of a function is uniquely defined.
because tunction acts on every element of the
domain.

Page No.

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Function	can be	represe	ented	10	920	ibnica	1 and
tabular +	arw.		1	344	19	1	
e.g. Let	A be a :	set of	9/	DESCRIPTION OF	10		
	¿a,b,c						
B =	ξ x, β, ?	87			111		
			X	B	8	8	
a.	→œ	a	V		101	la ser	
p	5 b	Ь			V		
C	31	С			V	4. 1.	
_ d.	737	d		-			
e.	C	e			-	1 11 1	17.11
f-	70	+			-	1	
	+					-	n-il-
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/ c		B	1		1711	-	1
- d	1	37		/	TR		
- le	7	100		1		-	
	1 +		f			1.0%	Range
A		В			- 3		0
	is called		10 0	lomai	0 0	of c	denoted
by Dom	(f). The	set B	15	call	od	00	41 0
andamo	in, and	not	3 fc	a) 1	0 6	AZ	the .
is a si	to toody	Ric	coll	-1			which
isasi	300	0 1 13	CCCCC	ea (18	iang	5.0 +

Page No._

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	Semester: III subject: DSGT Academic Year: 20 -20 and denoted by Rancf). And set B is Called as codomain.
	Called de codomais.
	Pre-image and Image of a function-
	A function f: A > B such that for each a EA, there exists a unique b e B such that
	(a, b) eR then a is called the pre-image of f and b is called the image of f.
*	Types of functions -
1	Onto or surjective function-
_	n i n is cond to be
	an onto function if every element of B is the image of one or more elements of A.
	the image of one or more elements of A.
	Anto function is also carea as so
-	or 'f' is ONTO if Ran(f) = B. : f: A > B is onto if for each b & B,
-	there exists a EA such that f(a)=b
-	there exists a consol policy of the
-	Let A=4a,b,c} and B={1,23 are two sets
_	
-	(a) (b) (a) (a) (b) (b) (b) (a) (b) (a) (a) (b) (b) (a) (a) (b) (a) (b) (a) (b) (a) (a) (b) (a) (a) (b) (a) (a) (a) (a) (b) (a)
	$\frac{1}{5}$ $\frac{1}{2}$ $\frac{1}$
	(c) f (c)=2.
	A B This is onto fun.



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ex- let A = {	1,2,3,43 and B=	a, b, c, d's and
$f(1) = \alpha$	(2, a), (3, d), (4, c) f(2) = a + f(3) = d	(3, b) j
ran (f) = 3	a.d. ch6 = 0	(1) f (1)
So this qu	no is onto function	m · 2 }
(2)		A 3
One to	One or Injective	function-
1 001010	D TOOM A to B	sold to be a
have the s	function if no to	two elements of A
and carried	as injective teines	dan
to let A=	21,2,3,47 and A	-Sahoder
and + - 7	(1,a)(2,e)(3,c)(4	(d)
f(3) = C	f(2)=e - f(4)=d	
	ne to one or ini	echin and
	To 0170 00 111	corne gan
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3)c	Milidian Intellector
4	f te	CHARLES THE
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Semester: 11) Subject: DS GT Academic Year: 2072-2023
and one to one function or Bijevive fundamento one onto one function if it is both an onto and one to one function. One to one onto function is also called as bijective function
ex. (et $A = \{1, 2, 3, 4\}$ $B = \{a, b, c, d\}$ and $f = \{(1, b)(2, c)(3, d)(4, a)\}$ f(1) = b $f(2) = c$ $f(3) = d$ $f(4) = athis fun is bijective fun 1$
4) Every where Defined function - A function from A to B is said to be every-
where defined if $Dom(f) = A$. ex. let $A = \{1,2,3\}$ $B = \{a,b,c\}$ and $f = \{(1,c)(2,b)(3,q)\}$ f(1) = c $f(2) = b$ This is everywhere $f(3) = a$ defined function $f(3) = a$ $f(3) =$

Page No._

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	Semester:	Academic Year: 2012 - 2023
*	* - xamples on functions -	
0	Det A= (a, 192, 933, B= & b1, b2	, b33, C= { c1, C23,
	D= & d1, d2, d3, d43 consider the functions from A to B., A to	following tour
	D to B respectively.	D / B To C TOTAL
	D to B respective, a> f1 = 2 (a, b23, (42, b3), (a3, b)	1)}
	$C > f3 = \{(b_1, (2), (b_2, (2)), (d_3, d_4), (d_4, d_4), (d_4, d_4), (d_4, d_4), (d_4, d_4), (d_5, d_5, d_4), (d_5, d_5, d_4), (d_5, d_5, d_5), (d_5, d_5, d$	172
	- (+4= + (d1101) (d2. h2) (d2 la)	73
	One whether each function is	ion is one to
-	whether each fun" is everywh	ese defined.
> -	a> f1 = { (a1, b2), (92, b3), (93, b	
	fi(a1)=b2 fi(a3)=b1	
	fr (a2) = b3 fr (a2) = b3	m(fi) - A
	fi is onto because Range (f1)=B
1	A 0 :	
-	1 1	ein because
	100	alaman Le d
1	In It is currective injective to	have same image
	So is surgestive, injective, bi	Jeenve and
	Subject Incharge : Page No. Departmen	of CSE-Data Science APSIT



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Ser	nester:	111		Subject :	DSGT		Academic Year: 20 22-20 23
5/2	f2	= \$	(a1, d2), (az	(di) . ((a3, d4) 3	
_	15(a1):	02	f2 C	92) = 0	11	
-	72((3)	= d4				RIL
_	42	is	every	where	deti	ned as	dom(f2)=A
-	+5	15	DOF	onto	tunn	Ran	(f2) \neq D.
_	72	2:1	one	to c	ine f	un.	
-	-	1		45.	5		
-	3710	/ art		>	Jodo-		100
-		Q2 -			da		
-		937			100		
-		V			-		
5	43	= \$	(b1. C2	2), (b2	L, (2)	Cb3, Ci) }
(-	f2	(61)	- (2		f3	(b2) = C	2_
	00	(10	1 - 01				
	13	is	ulya	shere	definal	fren "	because.
		Do	m (f3)	= B	U	_	
(f3	is	onto	surje	Hive	fun	because
		11 4	1111011	-			Acres de la companya della companya
	F3	isi	not o	ne to	004	fun.	
4 5		~					
		(b)		1	A .		distribution in
		L		\sim	00	B. Mi. Y	
	RO		/	-	>7		
		153					

Page No.___



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Semester :	111	Subject : DSGT		Academic Year: 2002 -	2013
d) f	4 = 2 (di,	b) (do b	Cla L	14	
	(91)=01	-fu	(d2) = h2		
	((d3) = b1				
-fy	is not or	nto fren 1	secause Re	in (fy) +B	
- 14	is not e	every where	defined	fren bea	aus
-fu	ic not	J. 0	0 0		
-tue	is not	one to	one tun	because	
	element	of set	1) have	same in	age
1	do	1			
	do	for			7
	44	[b3]	10		
X.		<u> </u>	V=4.1.1.1.1		91
Let	A = B = R,	the set of	mal au		
			1 to 70.5		
and I	let g:R-	A be qi	ven he	(u) - 3[.	
-1	The state of the s	3 3	9	V= 9	+-1
Show	that fig	s bijectio	n between	A and	3
and	g is a	bijection	between	Band A.	
1	•				
	nction fa			ijection 1	£
It is		x3-1-to	onto.	0	
+08	+(1)=2	X 1 10	be one -	o one for	nto.
LATER 3		1710			0
Subject Incha	irge :	Page No:	Department of	CSE-Data Science A	PSIT



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- that f(a) = f(b)
$\frac{2a^3-1}{2b^3-1} = 2b^3-1 \qquad 8a^3=2b^3=a^3-b^3$
f is one to one.
$\frac{11 + y = 2x^3 - 1}{1 + y = 2x^3}$
$\frac{2}{2} = \frac{1}{2} + \frac{1}{2}$
$\frac{\mathcal{Z}=3\left[1+\frac{y}{2}\right]}{\sqrt{2+2}}$
A such that $f(x) = y$.
f is onto
if is bijective fun between A and B. Similarly for g: B > A to be one to one of one
$g(a) = g(b) = \sqrt[3]{\frac{1}{2} + \frac{a}{2}} = \sqrt[3]{\frac{1}{2} + \frac{b}{2}}$
1/+ 9 = 1/+ b
9 - 6 - 1 0 1 1
$\begin{array}{cccccccccccccccccccccccccccccccccccc$
g is one to one.



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2x3=1+y y=2x3-1 for each x in A. There is a y in B. Such that a(y) = x	e orrespondine
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	
2x3=1+y y=2x3-1 for each x in A. There is a y in B. Such that a(y) = x	
12x3=1+4 y=2x3-1 for each x in A. There is a y in B. Such that a(y) = x	
2x3=1+y y=2x3-1 for each x in A. There is a y in B. Such that a(y) = x	
for each x in A. There is a y in B. Such that a(y) = x	corresponding
y in B. Such that aly) - x	correspondine
y in B. Such that aly) - x	correspondine
guch that aly) -x	000
- such that gly) = x.	
- 9 is onto function	
18 80 g & bijective function bet	B and A.
	0 4.0070
	0.0
Test whether the following tun	e Hiem is
f: z > z, f(x) = x2 + x +1	11011 13
f: z > z, f(x) = x2 + x +1:	
A tunction from A to B is	one la out
the no two elements of a 1-	one to one
imago. $X = -2$ $f(x) = x^2 + 2 \cdots$	the same
let, X = -2, f(x) = x+x+1	
$f(-2) = (-2)^2 + (-2) + 1$	
= 4 - 2 + 1	
= 3	
(et X = 1	
$f(1) = 1^2 + 1 + 1 = 3$ Elemen	its land -2
have same image so the function	is not one