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Course: Biscrete Maths and

Graph theory

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Course: MAT 2002

1) t: R -> R defined as f(x) = 2x +3 \ x & R. both one-one, onto fr.

ASSIGNMENT - 1

for one - one,

Let  $x_1, x_2 \in R$  such that  $f(x_1) = f(x_2)$ 

2x1+3= 2x2+3

2x, = 2x2

X1 = X2

fis one-one

11 const

2 5 d & 1 - 5 D & 10 & 10 & 10 & 1

2 (1+na) jur a >-

LIT ILEP and IMP

LU YER and for = y

y=2x+3

For onto,

 $\frac{y-3}{2} = x \in R$ 

: for each yer, there exists  $x \in R$  such that  $t\left(\frac{y-3}{2}\right) = y$ 

it is onto

(2)  $f, g: R \rightarrow R$  defined by f(x) = 2x + 1  $g(x) = \frac{\pi}{3} \quad \forall x \in R$ . continue that we

For to be one-one,

Act X,1 x2 ER. will of entering of white of the control of

 $f(x_1) = 2x_1 + 1$ ;  $f(x_2) = 2x_2 + 1$ 

.. An, + / = xx2+/

 $x_1 = x_2$  f(x) is one-one

For to be onto,

Let f(x) = y

they be the frame that B. 20 the : For every  $y \in R$ , there exists a  $x \in R$  such that f(y-1) = y

and the state of t

( MINE IN CENT IS

man 4 (1 - 4) 1 .

:. f(x) is onto.

For g to be one-one is and a managed manager to

her x11×2 & R.

 $g(x_1) = \frac{x_1}{3}$ ,  $g(x_2) = \frac{x_2}{3}$  and  $g(x_1) = \frac{x_2}{3}$ A do was = 2000 mu is every non money

g(x) is one-one.

for g-cx) to be onto, wit is (a) of a ransmin growth

alt glas = y

x = 34 ER

. For every yer, there exists xer such that f (3y)=4 i g(x) is onto.

. Both of them are one-one and onto functione, both the inverse functions exist.

2) to g: R -> R defined by b(x)=2x+1, g(x)= x x x cr. To verify: (gof) = f og -1 my in the more printing in the

= 9(f(x)) = 2x+1

$$f(y(x))^{-1} = y = \frac{2n+1}{3}$$

$$9 = \frac{24}{3} + \frac{1}{3}$$

- nd - h + h + + 1 = 1+ 2 (n + 1 = () + = + = + = ( + = ) + i = 1 = + ( + = + )

(E = 2(1+i)+1 5 62+ 10(1+i)+1 x (1-1) +1 & 1-4/0/2

curries to the man of the Allife

(1+a) = (1+a) (1+a)

RHS = 6'09" t (x) = 9x+1  $\frac{1}{2}(x) = \frac{1}{2}$  $\frac{1}{3} \left( g(x) \right)^{2} = \frac{3x-1}{2} = RHS$ : LHS = RHS Hence proved. 3) (a+1) n > 1+na for a>-12 n>2 Let P(n) = (1+a) > (1+na), for a>-1 For n= 2 LHS = (1+a)2 = (1+2a) = 14 a2 + 2 g = 1 + 2/a a2 10 . LHS & PEIS हें है है , निवाद द्यांप्रेस ... true ... P(1) is true) Let P(k) be true (1+ a) & 1+ ka = (x)8 , 1+ x = (x) & = = 1 we have to prove that P(k+1) is true. ive, (1+a) k+1 > 1+(k+1) a how, (1+a) k+1 > 1+kac (: P(k) is true (1+a)k(1+a) > (1+ka)(1+a)  $= (1+a)^{k+1} \ge 1 + ka + a + ka^2$  $(1+a)^{k+1} > 1+(k+1) a+ka^2 \longrightarrow (1)$ 

now, I+ (k+1) be + ka > I+ (k+1) a ... 2 : (1+a)^{k+1} > I+ (k+1) × : P(k+1) is true if P(k) is true P(n) is true  $\sqrt[4]{n}$  (A) 1.2 + 2.3 + 3.4 + ... + n(n+1) = n(n+1)(n+2)Let P(n)= 1.2 + 2.3 + 3.4 + ... n (n+1) = n(n+1) (n+2) For n=1, LHS = 2 14 pt ch = 6th LHS = RHS (E) by a to hongy in P(n) is true for n=1 1-145 = 1 Assume P(k) to be true 104 1-10 107 1.2 + 2.3 + 3.4 + ... +  $k(k+1) = \frac{k(k+1)(k+2)}{n}$ to P(k+1) to be true, Fee for the for the 1.2+2.3+3.4+... +(k+1).((k+1)+1)=(k+1)((k+1)+1)((k+1)+2)  $1.2 + 2.3 + 3.4 + \cdots (k+1)(k+2) = \frac{(k+1)(k+2)(k+3)}{3}$ (s) 1 351 5 1 135 3 1 1 1 1.2+2.3+3.4+... k(K+1)+(K+1)(K+2) = (K+1)(K+2)(K+3) we have to prove P(k+1) from P(k) From (), adding (k+1)(k+2) on both sides, (2) most 241  $1.2+2.3+3.4+...+k(k+1)+(k+1)(k+2)=\frac{k(k+1)(k+2)}{3}+(k+1).(k+2)$ 3 (k+1) (k+2) (k+3) which is same as P(k+1) 1= 1-44E = 4xp

.. P(K+1) is true & P(K) is true

natural number.

(3) - 1- 1- 15 1 x 15 =

of son what is (1) of a commencer management of the contract o

 $G_1 = 1$   $G_2 = 3$   $G_n = G_{n-1} + G_{n-2} + 1$   $n \geqslant 3$   $\longrightarrow$  (2) P(n) = Gn = 2 Fn - 1 Y n > 1 -> 3 het n=3 in 3 act n=2 in 1. 93=92+91+1=5 F2 = 2 I to Junia Putting n=1 in eq 3 91 = 25 -1 PHS 41 = 2-1 = 1 ZHS G1=1 F=1 LHS = RHS Assume P(k) is true (120) (1-1) (1-1) (1-1) (1-1) .. P(n) is true for n=1 (2 x) (1 d) - (2 - 4) (1 · 2) · · · · · · · · · · Gk = 2 Fk-1 Y N>1 → (1) Now to prove that P(k+1) is true. (E+x) (E+2)(1-1) = (-+4) (1-2) + (1+2) y . . . 1 LHS = GR+1 RHS = 2 F(k+1) LHS from (2) FRHI = FK + FK-1 GR+1 = GR+ Gk-1+1 sussituting 9k from 4 2 (FR+FR-1)-1 = 0 = 2FK-1+ GK-1+1 ( 2FK+2FK-1-1 -) ( ) (1:2) 1 - E was 4 9k-1 = 29k-1-1 me is (is) is one is (is)  $= 2F_{k} + 2F_{k-1} - 1 \longrightarrow (5)$ 

From (E) and (6) LHS = RHSM. WELLEN SETTLEMENT OF EXPENSE 13 days .. P(k+1) is true when P(k) is true

i. By principa of mathematical induction, P(n) is true \ n > 1 P(n): 9n = 2Fn-1

6 Proof by strong induction:

\* First define pens

P(n) = n. and can be written as the product of primes

\* Basic Step: Show P(2) is true

2 can be written as in product of one prime itself so P(2) is true)

\* Inductive step: Show & R>2 ([P(2) A... A P(K)] -> P(K+1)) is true

· Hypothesis:

i can be written as the product of prime when 2 & j < k.

1 = x = 1x) & Ry E

· Show P( K+1) true.

Case 1: (k+1) is prime

If (k+1) is prime, k+1 can be written as the

Product of one prime, itself. So, P(k+1) is true.

Case 2 (k+1) is composite

By inductive hypothesis, a and b can be written as the

hamely, those primes in the product of primes, and those in the factorization of a

:. P(k+1) is true

.. by strong induction & n P(n) is true

€= (x) € 120 = 13

in w

y = 3 ye & R

Bailed I fam was a JX more man 1 (3/1)