**Revision for Math-150**

**Choose the correct answer from the following**

**1)** Let be such thatf(x)= x+3, then =

(a)-1 (b) 1 (c) 5 (d) -5

**2)**What is the least possible number of multiplications by which a15 can be calculated for a given a (except for multiplications, any other arithmetic operations, such as raising to a power, are not allowed)?
 a) 3 b) 4 c)5 d) 6

**3)** If |A| = 4 and |B| = 5 then |AxB| =

(a) 9 (b) 16 (C)20 (d)25

|  |  |
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| Q. | **4)**  The binary expansion of (27)10 is |
|  | (a) (a) (10111)2 |  | (b) (11010)2 (c) (11101)2 (d)(11011)2 |
| **5)** The number of one-one functions from a set with m elements to a set with n |
| elements, where m > n is |
| 1. mn
 |  |  (b) m – n (c) m + n (d)Zero |

**6)**Which of the following is the Highest Common Factor of 18, 24 and 36?

(a)6 ( b) 18 (c) 36 (d)12

**7** The Principle of Mathematical Induction has
 a) 2 steps b)4 c)1 d)5

**8**-Which of the following is the induction hypothesis in a standard induction proof?
 a)P(n) is true for n=1 b) P(n) is true for n=1,2,3,……….,k
 c) P(n) is true for n=k d) P(n) is true for n=k+1

**9**- Which of the following is the induction hypothesis in a proof by strong induction?
 a) P(n) is true for n=1 b) P(n) is true for n=1,2,3,……………,k
 c) P(n) is true for n=k d) P(n) is true for n=k+1

**10**-What is the inductive reasoning to predict the next equation of 6\*8=7\*9-15, 8\*10=9\*11-19
 a) 19\*11=8\*9-15 b) 6\*8=7\*9-15
 azzzzzaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa

 c) 6\*9=8\*9-15 d) 10\*12=11\*13-23

**11**-Find is

1. 1600 b)10600 c)10060 d)100006

**12**-Find the prime factorization of 45617

**(a)**11· 11 · 13 · 29 (b)11· 13 · 13 · 29 (c)11· 11 · 11 · 29 (d)11· 11 · 17 · 29

**13**-Find the value of **18 mod 7**

1. 2 b)3 c)4 d)5

**14**-What is the coefficient of x7y12 in (x + y)19

1. b) c) d)

**15**-Which of the following recurrence relation is not homogeneous:

1. *an=an-1+an-2*
2. *an=an-1+n*
3. *an=an-2*
4. *None*

**16**-The recurrence relation *an=a2n-1+an-2* is

1. Not homogeneous
2. Linear
3. not linear
4. Of degree 3

**17**-Which recurrence relation is neither homogeneous nor linear:

1. *an=an-1*
2. *an=an-1+an-2*
3. *an=a2n-1+an-2+2*
4. *None*

**18**-The characteristic equation of the recurrence relation *an=2an-1-an-2* is

1. *r2+2r+1=0*
2. *r2+2r-1=0*
3. *r2-2r+1=0*
4. *r2-2r-1=0*

|  |  |
| --- | --- |
| Q. | **19** The binary expansion of (27)10 is |
|  | (a) (a) (10111)2 |  | (b) (11010)2 (c) (11101)2 (d)(11011)2 |
| **20** The number of one-one functions from a set with m elements to a set with n |
| elements, where m > n is |
| 1. mn
 |  |  (b) m – n (c) m + n (d)Zero |

**21** Which of the following is the Highest Common Factor of 18, 24 and 36?

 (a) 6 ( b) 18 (c) 36 (d)12

**Section II**

**Solve the following questions**

**Q (1):** Show that ￢*(p* ∨*(*￢*p* ∧*q))* and ￢*p* ∧￢*q* are logically equivalent by developing a series of logical equivalences

￢*(p* ∨ *(*￢*p* ∧ *q))* ≡ ￢*p* ∧￢*(*￢*p* ∧ *q)*

≡ ￢*p* ∧ [￢*(*￢*p)*∨￢*q*]

≡ ￢*p* ∧ *(p* ∨￢*q)*

≡ *(*￢*p* ∧ *p)* ∨ *(*￢*p* ∧￢*q)*

≡ **F** ∨ *(*￢*p* ∧￢*q)*

≡ *(*￢*p* ∧￢*q)* ∨ **F**

≡ ￢*p* ∧￢*q*

Consequently ￢*(p* ∨ *(*￢*p* ∧ *q))* and ￢*p* ∧￢*q* are logically equivalent.

**Q(2) :find the inverse of f(x)=2x+3**

F(x)=2x+3

X=2y+3

x-3=2y

y=

f-1(x) =

**Q (3) :**Find the binary expansion of (241)10, and Octal Expansion (12345)10

(241)10 =(11110001)2

(12345)10=(30071)8

**Q4**-Use mathematical induction to show that  whenever n is a nonnegative integer

Nonnegative means 0, 1, 2, …

1. Basis Step: plugging in n = 0

Both sides of P(0) shown in part (a) equal 1.

 Here we are just plugging in the smallest nonnegative integer and showing that both sides are equivalent.

For the inductive step, we want to show for each

 k ≥ 1 that P(k) implies P(k + 1).

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**Q5**-Show that < n! whenever n is an integer with n >= 7

Let *P(n)* be the proposition that 3*n < n*!.

*BASIS STEP:* To prove the inequality for *n* ≥ 7 requires that the basis step be *P(*7*)*. Note that

*P(*7*)* is true, because = It is true for n=7, since
 = 2187 < 7! = 5040!

where *k* ≥ 7, then 3*k*+1 *< (k* + 1*)*!. We have

3*k*+1 = 3 · 3*k* by definition of exponent

*<* 3 · *k*! by the inductive hypothesis

*< (k* + 1*)k*! because 3 *< k* + 1

= *(k* + 1*)*! by definition of factorial function

This shows that *P(k* + 1*)* is true when *P(k)* is true. This completes the inductive step of the

proof.

We have completed the basis step and the inductive step. Hence, by mathematical induction

*P(n)* is true for all integers *n* with *n* ≥ 7. That is, we have proved that 3*n < n*! is true for all

integers *n* with *n* ≥ 7.

**Q6**-Use the Euclidean algorithm to find

1. gcd(203,101).

203=101\*2+1

101=1\*101+0

Gcd=1

1. gcd(34,21).

34=21\*1+13

21=13\*1+8

13=8\*1+5

8=5\*1+3

5=3\*1+2

3=2\*1+1

2=1\*2+0

Gcd=1

**Q7**-Suppose that{an}is defined recursivelybyan=aandthat a0=2.Finda3 anda4.

We see from the recurrence relation that a1 = a0 -1 = . It then follows

that a2 = - 1 = 8 and a3 =-1 = 63 and . a4=-1=3968

**Q8**-Find the value of each of the following quantities.



C(5,4) =5

= 5

1. b) C(5,0) =1

=1

1. c) P(5,1) = 5

=5

1. d)P(5,5)=120

**=120**

**Q 9**-What is the solution of recurrence relation

*an=an-1+2an-2* with *a0=2* and *a1=7*?

r2-r-2=0

an=a12n+a2(-1)n

*a0=2=a1+a2*

 *a1=7=a1\*2+a2\*(-1) a1=3 a2=-1*

*an=3\*2n-(-1)n*

**Q10.**.Determine which of the following relations are linear homogeneous recurrence relation with constant coefficients. Also find the degree of those that are.

1. *an=3an-1+4an-2+5an-3*

linear homogeneous degree 3

1. *an=an-2*

linear homogeneous degree 2

1. *an=an-1+a2n-2*

*Not linear* homogeneous*, degree 2*

1. *an=an-1+n*

*Not linear* homogeneous *, degree 1*

1. *an=an-1+an-4*

*linear* homogeneous *, degree 4*

**Q11**.Let *R* be the relation on **Z** ×**Z** ×**Z** consisting of all triples of integers *(a, b, c)* in which *a*, *b*, and *c* form an arithmetic progression. That is, *(a, b, c)* ∈*R* if and only if there is an integer *k* such that *b* = *a* + *k* and *c* = *a* + 2*k. F*ind two triples belong to this relation and two triples not belong to R

that *(*1*,* 3*,* 5*)* ∈ *R* because 3 = 1 + 2 and 5 = 1 + 2 ・ 2, but *(*2*,* 5*,* 9*)*  *R* because

5 − 2 = 3 while 9 − 5 = 4. This relation has degree 3 and its domains are all equal to the

set of integers.

**Q12**-Draw the directed graph with vertices a, b, c, and d, and edges (a, b), (a, d), (b, b), (b, d), (c, a), (c, b), and (d, b)

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**Q13**.In the graph *G* we have, find in degree and out degree



The in-degrees in *G* are deg−*(a)* = 2, deg−*(b)* = 2, deg−*(c)* = 3, deg−*(d)* = 2,deg−*(e)* = 3, and deg−*(f )* =

 The out-degrees are deg+*(a)* = 4, deg+*(b)* = 1, deg+*(c)* = 2,deg+*(d)* = 2, deg+*(e)*=3, and deg+*(f )* = 0.