MIDTERM EXAMINATION
Spring 2011
MTH202- Discrete Mathematics

Question no 1: marks (3)

Check whether it is the function

$$f(n) = \frac{1}{n^2+1}$$ **Chapter 15**

Question no 2: Marx (5)
If a relation of A and B are reflexive and transitive then shows that their intersection is reflexive and transitive.

Lecture 13
Solution is on Page 11

Question no 3: Marx (3)

If -9,-6,3,….66 series then find its nth term.

Here $a = -9$

$d = (-6) - (-9)$

$d = 3$

$n = ?$

Formula for arithemetic series.

$a_n = a + (n-1)d$

$66 = (-9) + (n-1) \times (3)$

$66 + 9 = (n-1)(3)$

$\frac{75}{3} = n - 1$

$25 = n - 1$

$n = 25 + 1$

$n = 26$

Question no 4:

Question no 4 : Marx (2)

If

$a_2 = \frac{1}{n^2 + 1}$

Find its first four series of sequence??

Question no 4: Marx (5)
If relation R is transitive then shows that its inverse is also transitive???

Solution:

Suppose that the relation R on A is transitive. Let (a, b) ∈ R-1and (b, c) ∈ R-1.
Then by definition of R-1, (b, a) ∈R and (c, b) ∈R. Now R is transitive, therefore if (c, b) ∈R and (b, a) ∈R then (c, a) ∈R.
Again by definition of R-1, we have (a, c) ∈ R-1. We have thus shown that for all a, b, c ∈ A, if (a, b) ∈ R-1and (b, c) ∈ R-1then (a, c) ∈ R-1.
Accordingly R-1 is transitive

Question no 6: (2)

If set (A,B) relation R is
(2,3)(6,5)(5,4)
Find its domain and rang??

Solution:

Domain: {2,6,5}

Range: :{3,5,4}

MIDTERM EXAMINATION
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MTH202- Discrete Mathematics

Q No. 1

$$Q(a,b)=\begin{cases}5 & \text{if } a\langle b\\ Q(a-b,b+2)+1 & \text{if } b\le a\end{cases}$$

find the following points

Q(5, 3) = ?

Solution:

$In\,Q(5,3)\qquad b<a$

$for\; b<a, the\; function\, is:$

$Q(a-b,b+2)+1$

$therefore,$

$Q(5,3)=Q(2,5)+1$

$Now\, a<b\, and\; the\; function\; for\; a<b\, is:$

5

$therefore,$

$Q(2,5)+5\qquad =5+1$

$\qquad\qquad\qquad =6$

Q No.2

$$Q(a,b)=\begin{cases}5 & \text{if } a\langle b\\ Q(a-b,b+2)+1 & \text{if } b\le a\end{cases}$$

find the following points

Q(15, 2) = ?

Solution:

$for\ Q(15,2) \quad here\ b < a$

$funtion\ for\ b < a\ is: Q(a-b, b+2)+1$

therefore,

$Q(15,2) = Q(13,4)+1$

$= [Q(9,6)+1]+1 \qquad = Q(9,6)+2$

$= Q(3,8)+2+1 \qquad = Q(3,8)+3$

$Now\ a < b\ and\ function\ for\ it\ is: 5$

therefore,

$= Q(3,8)+3 = 5+3 = 8$

Q No.3

$R = \{(1,y),(2,x),(2,y),(3,x)\}$

find the domain and range of the above relation

Ans;

dom={1,2,3}

ran={x,y}

Q No.4

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \qquad M_S = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

$find\ the\ RoS\ and\ Ros^{-1}....??$

that same example in the 14th lecture..

Solution:

$$RoS = \begin{bmatrix} 1.0+0.0+1.1 & 1.1+0.0+1.0 & 1.0+0.1+1.1 \\ 1.0+1.0+0.1 & 1.1+1.0+0.0 & 1.0+1.1+0.1 \\ 0.0+0.0+0.1 & 0.1+0.0+0.0 & 0.0+0.1+0.1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$RoS^{-1} = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix}$$

Q No.5 Sum of the given natural series?

$1^2 + 3^2 + 5^2 + ... =$

Solution :

that can be calculated by the following formula

$$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$$

Q No 6
R= {(0, 0), (0, 2), (0, 3), (1, 0), (1, 1), (2, 2), (3, 0), (3, 3)}
Find that relation is reflexive, symmetric and transitive…??

MIDTERM EXAMINATION
Spring 2011
MTH202- Discrete Mathematics

Question No: (Marks: 2)

$R = \{(1, y), (2, x), (2, y), (3, x)\}$

find the domain and range of the above relation

Solution :

dom={1,2,3}

ran={x,y}

Question No: (Marks: 5)

f(x) = x^2 +1 and g(x) = x + 2

find (f. g)x and (f-g)x
Solution:

$$f.g(x) = f(x).g(x)$$
$$= (x^2+1).(x+2)$$
$$= x^3 + 2x^2 + x + 2$$

$$(f-g)x = f(x) - g(x)$$
$$= (x^2+1) - (x+2)$$
$$= x^2 - x - 1$$

MIDTERM EXAMINATION
Spring 2010
MTH202- Discrete Mathematics (Session - 2)

Question No: 21 (Marks: 2)
Let R be the relation on from A to B as
R={(1,y) ,(2,x) ,(2,y),(3,x)}
Find
(a) domain of R
(b) range of R

Solution:
The **domain of a relation** R from A to B is the set of all first elements of the ordered pairs which belong to R denoted Dom(R).
The **range of A relation** R from A to B is the set of all second elements of the ordered pairs which belong to R denoted Ran(R).

Domain of the Function are: {1,2,3}
Range of the Function are: {y,x}.

Question No: 22 (Marks: 2)
Let a and b be integers. Suppose a function Q is defined recursively as follows:

$$Q(a,b) = \begin{cases} 5 & \text{if } a \langle b \\ Q(a-b, b+2) + a & \text{if } b \le a \end{cases}$$

Find the value of Q(2,7)
Solution:

$In\, Q(2,7) \qquad a < b, i.e\, 2 < 7$

$For\ a < b, the\ function\ is:$

5

$therefore,$

$Q(2,7) = 5$

Question No: 23 (Marks: 3)
Suppose that R and S are reflexive relations on a set A. Prove or disprove $R \cap S$ is reflexive.
SOLUTION:

R ∩ S is reflexive:

Suppose R and S are reflexive.
Then by definition of reflexive relation

$\forall$ a $\in$A (a,a) $\in$R and (a,a) $\in$S

$\Rightarrow \forall$ a $\in$ A (a,a) $\in$ R ∩ S

(by definition of intersection)

Accordingly, R ∩ S is reflexive

Question No: 24 (Marks: 3)

Find the sum of the infinite G.P. $2, \sqrt{2}, 1, \ldots$

Solution:

Here,

$a = 2$

$r = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$

$$\text{Sum} = \frac{a}{1-r}$$

$$= \frac{2}{1 - \frac{1}{\sqrt{2}}}$$

$$= \frac{2}{\frac{\sqrt{2}-1}{\sqrt{2}}}$$

$$= \frac{2\sqrt{2}}{\sqrt{2}-1}$$

Question No: 25 (Marks: 5)

If $f(x) = \frac{x}{2} + 3$ *and* $g(x) = \frac{3}{4}x - 2$

then find the value of

$5f(-2) - 7g(-4)$

Solution:

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

$$g(x) = \frac{3}{4}x - 2$$
$$g(-4) = \left[\frac{3}{\not 4}(-\not 4)\right] - 2$$
$$g(-4) = \left[3 \times (-1)\right] - 2$$
$$g(-4) = -3 - 2$$
$$g(-4) = -5$$

therfore.

$$5f(-2) - 7g(-4) = [5 \times 2] - [7 \times (-5)]$$
$$= 10 - (-35)$$
$$= 10 + 35$$
$$= 45$$

Question No: 26 (Marks: 5)

Write the geometric sequence with positive terms whose second term is 9 and fourth term is 1

1.

SOLUTION:

Let **a** be the first term and **r** be the common ratio of the geometric sequence. Then

$a_n = ar^{n-1}$ $n \geq 1$

Now $a_2 = ar^{2-1}$

$\Rightarrow 9 = ar$…………………(1)

Also $a_4 = ar^{4-1}$

$1 = ar^3$ …………………(2)

Dividing (2) by (1), we get,

$$\frac{1}{9} = \frac{ar^3}{ar}$$

$$= \frac{1}{9} = r^2$$

$$r = \frac{1}{3} \quad \left(rejecting\ r = -\frac{1}{3} \right)$$

Substituting r = 1/3 in (1), we get

$$9 = a\left(\frac{1}{3}\right)$$

$$9 \times 3 = a$$

$$a = 27$$

Hence the geometric sequence is
27, 9, 3, 1, 1/3, 1/9……

MIDTERM EXAMINATION
Spring 2010
MTH202- Discrete Mathematics (Session - 4)

Question No: 21 (Marks: 2)
Let the real valued functions f and g be defined by
f(x) = 2x + 1 and g(x) = $x^2 - 1$
obtain the expression for fg(x)

Solution:

$$fg(x) = f(x^2 - 1)$$

$$f(x^2 - 1) = 2(x^2 - 1) + 1$$

$$= 2x^2 - 2 + 1$$

$$= 2x^2 - 1$$

Question No: 22 (Marks: 2)
Given A = $\{1,2,3,4\}$ $and\ B = \{x, y, z\}$. Let R be the following relation from A to B:

$$R = \{(1, y), (1, z), (3, y), (4, x), (4, z)\}$$

Determine the matrix of the relation.

Solution:

$$\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array}\begin{array}{c} \begin{matrix} x & y & z \end{matrix} \\ \begin{pmatrix} 0 & 1 & 1 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix} \end{array}$$

Question No: 23 (Marks: 3)
Determine whether f is a function if

$$f(n) = \sqrt{n}$$

F is defined for n<0, since then f results in imaginary values that is not real.

Question No: 24 (Marks: 3)
Find the 5th term of the G.P. 3,6,12,…

Solution:

Here $a = 3$

Common ratio $= \frac{6}{3} = 2$

$n = 5$

we have to find 5th term $= a_5 = ?$

$a_{n=} ar^{n-1}$

$a_5 = (3)(2)^{5-1}$

$a_5 = (3)(2)^4$

$a_5 = (3)(16)$

$a_5 = 48$

Question No: 25 (Marks: 5)
Let f and g be the functions defined by
f(x)= 2x+3 & g(x)= 3x+2 then find

1. Composition of f and g.
2. Composition of g and f.

Solution:

1. $fog(x) = f(3x+2)$

$$f(3x+2) = 2(3x+2)+3$$
$$= 6x+4+3$$
$$= 6x+7$$

2. $gof(x) = g(2x+3)$

$$g(2x+3) = 3(2x+3)+2$$
$$= 6x+9+2$$
$$= 6x+11$$

Question No: 26 (Marks: 5)

Let f : R $\rightarrow$ R be defined by

$$f(x) = \frac{2x+1}{2x+2}$$

Is f one-to-one?

The function is not defined at x = -1
Hence m the function is not one

According to definition of 1-1 function
f(x1)=f(x2)
(2x+1)

MIDTERM EXAMINATION

Spring 2009

MTH202- Discrete Mathematics (Session - 1)

Question No: 21 (Marks: 2)

What is the difference between {a,b} and {{a,b}}?

Solution:

{a,b} is a set while {{a,b}} is a subset of some set.

Question No: 22 (Marks: 3)

the following in symbolic form:
(a) Ali reads The Nation or The News, but not Dawn.
(b) It is not true that Ali reads The Nation but not Dawn.
(c) It is not true that Ali reads Dawn or The News but not The Nation.

Question No: 24 (Marks: 10)

Test the validity of the following argument,

If Nomi studies then he will not fail in mathematics
If he does not play basket ball then he will study

But he failed in mathematics.
Therefore he played basket ball.

MIDTERM EXAMINATION
Spring 2009
MTH202- Discrete Mathematics (Session - 1)

Question No: 21 (Marks: 2)
If A = {1, 3, 5} then find two proper subsets of A.

Solution:
{1,3},{3,5}.

Question No: 23 __ (Marks: 5)
Let A={1,5,9} and B={6,7}
Then find Cartesian product from A to B and from B to A. Is both are equal or not .Also Justify your result.

Solution:

$$A\times B=\{1,5,9\}\times\{6,7\}$$
$$=\{\{1,6\},\{1,7\},\{5,6\},\{5,7\},\{9,6\},\{9,7\}\}$$
$$B\times A=\{6,7\}\times\{1,5,9\}$$
$$=\{\{6,1\},\{6,5\},\{6,9\},\{7,1\},\{7,5\},\{7,9\}\}$$

This justifies that AxB is not Equal to BxA.

MIDTERM EXAMINATION
Spring 2009
MTH202- Discrete Mathematics (Session - 2)

Question No: 22 (Marks: 3)
How many terms of the series – 9 – 6 – 3 + 0 +…amount to 66

Solution:

Here $a = -9$

$d = (-6) - (-9)$

$d = 3$

$n = ?$

Formula for arithemetic series.

$a_n = a + (n-1)d$

$66 = (-9) + (n-1) \times (3)$

$66 + 9 = (n-1)(3)$

$\frac{75}{3} = n - 1$

$25 = n - 1$

$n = 25 + 1$

$n = 26$

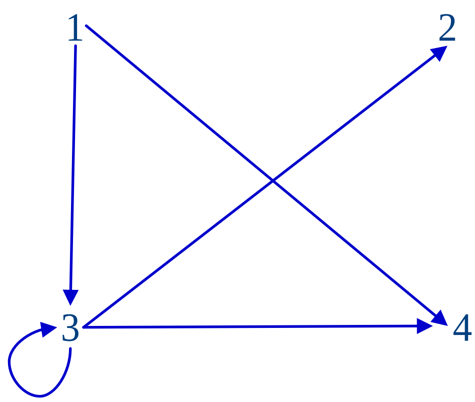
MIDTERM EXAMINATION
Spring 2009
MTH202- Discrete Mathematics (Session - 3)

Question No: 21 __ (Marks: 2)
Let the real valued functions f and g be defined by
f(x) = 2x + 1 and g(x) = x_2 – 1 obtain the expression for fg(x)
Repeated

Question No: 23 __ (Marks: 5)
Write the geometric sequence with positive terms whose second term is 9 and
Fourth term is 1.
Repeated

Question No: 24 (Marks: 10)
Let R be the following relation on A={1,2,3,4}:
R={(1,3) ,(1,4) ,(3,2), (3,3) ,(3,4)}
(a) Find the matrix M of R.
(b) Draw the directed graph of R.

$$\begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 0 & 1 & 1 \\ 2 & 0 & 0 & 0 & 0 \\ 3 & 0 & 1 & 1 & 1 \end{array}$$



MIDTERM EXAMINATION
SUMMER 2007
MTH202 - DISCRETE MATHEMATICS (Session - 1)

Question No: 6 (Marks: 8)
Test the following argument for validity:

Logic is difficult or not many students like logic.
If Mathematics is easy, then logic is not difficult.
Therefore,
Mathematics is not easy or logic is difficult

Question No: 7 (Marks: 9)
Let A = {a, b, c, d} and define the null relation ϕ and universal relation $A \times A$ on A. Test these relations for reflexive, symmetric and transitive properties

Solution:

Reflexive:

(i) ∅ is not reflexive since (a,a), (b,b), (c,c), (d,d) ∉ ∅.
(ii) A × A is reflexive since (a,a) ∈ A × A for all a ∈ A.

Symmetric

(i) For the null relation ∅ on A to be symmetric, it must satisfy the implication:
if $(a,b) \in \emptyset$ then $(a, b) \in \emptyset$.
Since $(a, b) \in \emptyset$ is never true, the implication is vacuously true or true by default. Hence ∅ is symmetric.
(ii) The universal relation A × A is symmetric, for it contains all ordered pairs of elements of A. Thus,
if $(a, b) \in A \times A$ then $(b, a) \in A \times A$ for all a, b in A.

Transitive
(i) The null relation ∅ on A is transitive, because the implication.
if $(a, b) \in \emptyset$ and $(b, c) \in \emptyset$ then $(a, c) \in \emptyset$ is true by default,
since the condition $(a, b) \in \emptyset$ is always false.
(i) The universal relation A × A is transitive for it contains all ordered pairs of elements of A.

Accordingly, if $(a, b) \in A \times A$ and $(b, c) \in A \times A$ then $(a, c) \in A \times A$ as well

Question No: 8 (Marks: 4)
Let f and g be the functions from the set of integers to the set of integers defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$ .What is the composition of f and g ? What is the composition of g and f?
Repeated;

Question No: 9 (Marks: 9)
If the 5^{th} element of an arithmetic sequence is -16 and the 20^{th} term is -46.
Then find 10^{th} term.
(Note: Use the proper formula of sequence)

Solution:
Let **a** be the first term and **d** be the common difference of the arithmetic sequence.

Then
$a_n = a + (n - 1)d \quad n \geq 1$
$\Rightarrow a_5 = a + (5 - 1) d$
and $a_{20} = a + (20 - 1) d$
Given that $a_5 = -16$ and $a_{20} = -46$. Therefore
$-16 = a + 4d$……………………(1)
and $-46 = a + 19d$…………………..(2)
Subtracting (1) from (2), we get,
$30 = -15d$
$\Rightarrow d = -2$
Substituting d = 2 in (1) we have
$-16 = a + 4(-2)$
$-16 = a+(-8)$
$a = -16+8$
$a = -8$

Thus, $a_n = a + (n - 1) d$

$a_n = -8 + (n - 1)(-2)$ (using values of a and d)

Hence the value of 10th term is

$a_{10} = -8 + (10 - 1)(-2)$

$= -8 + (9)(-2)$

$= -8-18$

$= -26$

MIDTERM EXAMINATION

SPRING 2007

MTH202 - DISCRETE MATHEMATICS (Session - 4)

Question No: 7 (Marks: 5)

Show that by the laws of logics.

$\sim\left(p \vee (\sim p \wedge q) \right) \equiv \sim p \wedge \sim q$

Question No: 8 (Marks: 5)

Find the sum of the geometric series

$1+\frac{1}{3}+\frac{1}{9} \quad ......to 15\text{th term}$

Solution:

$r = \frac{\text{2nd term}}{\text{1st term}} = \frac{1/3}{1} = \frac{1}{3}$

simplilarly $\frac{3rd \text{ term}}{2nd \text{ term}} = \frac{1/9}{1/3} = \frac{1}{3}$

a is the first term, which here is 1

$\text{Sum}=\frac{a\left(1-r^n\right)}{1-r} = \frac{1\left(1-(1/3)^{15}\right)}{1-1/3} \approx 1.5$

Question No: 9 (Marks: 10)

Consider the following data for 120 students in a MCS class concerning the courses Discrete Mathematics (D), JAVA (J) and SQL (S)

65 study D

45 study J

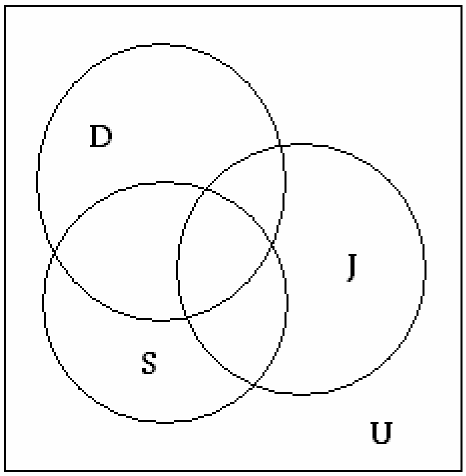
42 study S

20 study D and J

25 study D and S

15 study J and S

8 study all three courses
Find the number of students who study at least one of the three courses and to fill in the correct number of students in each of eight regions of the Venn diagram as shown in the following figure:



Question No: 10 (Marks: 10)
For all integer a and b∈Z. We define a relation R such that
$aRb \Leftrightarrow a \equiv b \pmod{n}$
.Let $n \neq 0$ *be* any fixed integer such that.
$n \mid (a - b)$
Show that R is an equivalence relation.

MTH202 Discrete Mathematics
Spring 2006
Mid Term Examination

Question No.1 (Marks 5)
Let f: R → R be the function defined by
f(x)=5x+1, Find $f^{-1}(x)$
Solution:
$f(x) = 5x + 1 = y$
$y = 5x + 1$
$5x = y - 1$
$x = \frac{y-1}{5}$
$f^{-1}(y) = \frac{y-1}{5} \qquad \therefore x = f^{-1}(y)$

Question No.3 (Marks 10)

Let f : R → R be defined by the rule f (x) = x^3. Show that f is bijective.

SOLUTION:

f is one-to-one

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

$\Rightarrow x_1^3 = x_2^3$

$\Rightarrow x_1^3 - x_2^3 = 0$

$\Rightarrow (x_1 - x_2)(x_1^2 + x_1x_2 + x_2^2) = 0$

$\Rightarrow x_1 - x_2 = 0$ or $x_1^2 + x_1x_2 + x_2^2 = 0$

$\Rightarrow x_1 = x_2$ (the second equation gives no real solution)

Accordingly f is one-to-one.

f is onto

Let y ∈R. We search for a x ∈R such that

f(x)=y

$\Rightarrow x^3 = y$ (by definition of f)

or $x = (y)^{1/3}$

Hence for y ∈R, there exists $x = (y)^{1/3} \in R$ such that

$f(x) = f((y)^{1/3})$

$= ((y)^{1/3})^3 = y$

Accordingly f is onto.

Thus, f is a bijective.

Question No.6 (Marks 10)

Find the 7^{th} term of the following geometric sequence

4, 12, 36,108…

Solution:

Here,

$a = 4$

$r = \frac{12}{4} = 3$

$n = 7$

$a_7 =$ Value of 7th term $= ?$

Formula for geometric series

$a_n = ar^{n-1}$

$a_7 = (4)(3)^{7-1}$

$= (4)(3)^6$

$= 4 \times 729$

$= 2916$

Question No.8 (Marks 10)
Give the logical proof of the following theorem with the help of truth table
$\sim(p \vee q) \equiv \sim p \wedge \sim q$

Question No.8 (Marks 10)
Find the sum of infinite geometric series :
$\frac{9}{4}+\frac{3}{2}+1+\frac{2}{3}+\ldots.$

Solution:

Here,

$$a=\frac{9}{4}, r=\frac{\frac{3}{2}}{\frac{9}{4}}=\frac{3}{2}\times\frac{4}{9}=\frac{12}{18}=\frac{2}{3}$$

$$S=\frac{a}{1-r}$$

$$S=\frac{\frac{9}{4}}{1-\frac{2}{3}}=\frac{\frac{9}{4}}{\frac{3-2}{3}}=\frac{\frac{9}{4}}{\frac{1}{3}}=\frac{9}{4}\times\frac{3}{1}=\frac{27}{4}$$

MIDTERM EXAMINATION SEMESTER
SPRING 2005
MTH202 – Discrete Mathematics

Question No.7 (Marks 5)
Give the logical proof of the following theorem with the help of truth table
$\sim(p \vee q) = \sim p \wedge \sim q$

Question No.9 (Marks 10)
Find the 18th term of the Arithmetic sequence, if its 6th term is 19 and 9th term is 31.

Solution:

Formula for Arithemetic series.

$a_n = a + (n-1)d$

$a_6 = a + (6-1)d$

$a_6 = a + 5d$

$a_9 = a + (9-1)d$

$a_9 = a + 8d$

given that $a_6 = 19$ and $a_9 = 31$

therefore,

$19 = a + 5d ......(1)$

$31 = a + 8d ......(2)$

subtracting equation (1) and (2)

$-12 = -3d$

$d = \frac{-12}{-3} = 4$

Putting the value of d in equation (1)

$19 = a + 5(4)$

$19 = a + 20$

$a = 19 - 20$

$a = -1$

Thus,

$a_n = a + (n-1)d$

$a_{18} = -1 + (18-1)(4)$

$a_{18} = -1 + (17)(4)$

$a_{18} = -1 + 68$

$a_{18} = 67$

Question No.10 (Marks 10)
Let A={0,1,2,3,4} and a relation B and C on A as follows:
B={(0, 0),(0, 1)(4, 3),(4, 4), (1, 3),(2, 2) ,(3, 0),(3, 3)}
C={(0, 0),(1, 2),(3, 3) (4, 4),(2,2),(1,1),(2,1)}
a. Is B reflexive? Symmetric? Transitive?
b. Is C reflexive? Symmetric? Transitive?

Discrete Mathematics
MTH 202
Semester Fall 2004

Question No.6 (Marks 5)
Construct truth table for the following compound proposition
$(p \to q) \leftrightarrow (p \wedge q)$

Solution:

p	q	p→ q	$p \wedge q$	$(p \to q) \leftrightarrow (p \wedge q)$
T	**T**	**T**	**T**	**T**
T	**F**	**T**	**F**	**F**
F	**T**	**F**	**F**	**T**
F	**F**	**T**	**F**	**F**

Question No.7 (Marks 5)
What are the contra positive , the inverse , and the converse of the implication
“If you have flu then you will miss the final examination”

Solution:
Let p = you have flu
Q = you will miss the final examination
Contra positive
$\sim q \to \sim p$
If you will not miss the final examination then you have no flu.
Inverse
$\sim p \to \sim q$
If you have no flu then you will not miss the final examination
Converse
$q \to p$
If you will miss the final examination then you have flu.

Question No.8 (Marks 10)
Determine whether the relation R on the set of integers is transitive, where $x, y \in R$ if and only if $2|(x-y)$
Solution:
To show that R is reflexive, it is necessary to show that

For all $x, y, z \in Z$ *if* $x\ R\ y,\ y\ R\ z$ *then* $x\ R\ z$
By definition of R this means that
For all $x, y, z \in Z$, *if* $2|(x-y), 2|(y-z)$ *then* $2|\ (x-z)$
Now by definition of "divides"
$2|(x-y)$
$x-y = 2k$ *for some integer k*
Now by definition of "divides"
$2|(y-z)$
$y-z = 2m$ *for some integer m*
$(x-y) + (y-z) = 2k + 2m$
$x-z = 2\ (k+m)$
Since k and m are integers then $k+m$ is also an integer
Let $k+m = s$ *for some integer s*
$x-z = 2s$
This implies that $2|\ (x-z)$
It follows that R is Transitive

Question No.9 (Marks 5)
Let A , B and C be sets .Show that

$$\left(A\cup\left(B\cap C\right)\right)^c$$

Solution

$$\left(A\cup\left(B\cap C\right)\right)^c$$

$$=A^c\cap\left(B\cap C\right)^c \text{ By De Morgan's Law}$$

$$=A^c\cap\left(B^c\cup C^c\right) \text{By De Morgan's Law}$$

$$=\left(B^c\cup C^c\right)\cap A^c \text{ commutative law of intersection}$$

$$=\left(C^c\cup B^c\right)\cap A^c \text{ By commutative law of union}$$

Question No.10 (Marks 5)
If the 3rd element of an arithmetic series is -16 and the 20th term is -46. Then find the 10th term?

Question No.11 (Marks 5)
Suppose that the relation R on a set is represented by the matrix

$$M_R = \begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \end{pmatrix}$$

Is R reflexive, symmetric, and/or anti symmetric?

Solution:
Since all the diagonal elements of this matrix are equal to 1, R is reflexive. Moreover, since M_R is symmetric

because $M_R = M^t_R$, it follows that R is symmetric. But R is not anti symmetric.