1. Let $A_1, A_2, ...., A_n$ be sets, where $n$ is a fixed natural number. Consider the following statements:
   (1) if $A = \bigcap_{i=1}^{n} A_i$ is countable infinite, then $\exists$ at least one $A_i$ for $i = 1, 2, ...., n$ which is countable
   (2) if $A = A_1 \times A_2 \times .... \times A_n$ is countably infinite then each $A_i$ for $i = 1, 2, ...., n$ is countable
   (a) 1 is correct and 2 is incorrect
   (b) 2 is correct and 1 is incorrect
   (c) Both are correct
   (d) Neither 1 nor 2 are correct
2. Which set is/are uncountable?
   (a) The set of all polynomials with real coefficients
   (b) The set of all subset of a countably infinite set.
   (c) The set $A - B$ where $A$ is uncountable but $B$ is countable
   (d) The set of all finite subsets of $\mathbb{N}$
3. Consider the following statements.
   (1) Every infinite set is equivalent to one of its proper subset
   (2) If a set is equivalent to one of its proper subset then it is infinite set. Then
   (a) 1 is correct and 2 is incorrect
   (b) 2 is correct and 1 is incorrect
   (c) Both are correct
   (d) Both are incorrect
4. If there are injective maps $f : A \to C \,\&\, g : C \to A$. Then
   (a) $A \,\&\, C$ both are uncountable
   (b) $A \,\&\, C$ both are countable
   (c) $A \,\&\, C$ both are finite sets.
   (d) $A \,\&\, C$ have the same cardinality.
5. If there is no one-one map from set of natural number $\mathbb{N}$ to A where A be any set then
   (a) A is finite set (b) A is infinite set
   (c) A is similar to $\mathbb{N}$ (d) None of these
6. Let $A \,\&\, B$ are infinite sets. Let $f$ is a map from $A$ to $B$ such that the collection of pre images of any non-empty subset of $B$ is non empty. Then Choose the incorrect?
   (a) If $A$ is countable then $B$ is countable
   (b) Such map $f$ is always onto
   (c) $A \,\&\, B$ are similar
   (d) $B$ may be countable even if $A$ is not countable
7. Let $A$ be the set of lines passing through the origin and slope is integral multiple of $\frac{\pi}{12}$ Then
   (a) $A$ is similar to $\mathbb{R}$
   (b) $A$ is countable infinite
   (c) $A$ is similar to the set of months in a year
   (d) $A$ is similar to the power set of $\mathbb{R}$
8. Let $A$ an infinite set of disjoint open sub intervals of $(0,1)$. Let $B$ be the power set of $A$. Then
   (a) $A \,\&\, B$ are cardinally equal
   (b) $A$ is similar to $(0,1)$
   (c) $B$ is similar to $(0,1)$
   (d) $A \,\&\, B$ both are uncountable
9. Consider the set $S = \{x + iy : x \text{ and } y \text{ are real and } x, y \in (0,1)\}$. Then
   (a) $S$ is uncountable and unbounded
   (b) $S$ is countable and bounded
   (c) $S$ is countable and unbounded
   (d) $S$ is uncountable and bounded
10. If $f : A \to B$ one-one map and $A$ is countable. Then which is correct
    (a) $B$ is countable
    (b) $B$ is uncountable
    (c) There exist a subset of $B$ which is countable
    (d) None of these
11. If $f$ be a function with domain $A$ and range $B$ then which of following is correct.
    (a) $B$ countable $\Rightarrow A$ countable
    (b) $A$ countable $\Rightarrow B$ countable
    (c) $A$ uncountable $\Rightarrow B$ uncountable
    (d) All of the above
12. Which of the following is correct?
    (a) The set of rational number in any interval of finite length is countable
    (b) The set of irrational number in any interval of finite length is countable
    (c) Every subset of uncountable set is uncountable
    (d) All of the above

13. Select the correct statements

1. Every countable set is similar to $\mathbb{N}$
2. The set of all disjoint intervals is not similar to the set of real numbers
3. The power set of $\mathbb{N}$ is similar to the set of real numbers Code:

(a) 1 and 2 only (b) 2 and 3
(c) 1 and 3 (d) All of these

14. If $S$ be a countable subset and $T$ be an uncountable subset of $\mathbb{R}$. Which of the following is/are true?

(a) $S \cup T$ is uncountable
(b) $S \cap T$ is at most countable.
(c) $S - T$ is at most countable.
(d) $T - S$ is uncountable.

15. Let $F$ be the set of all the functions $f : N \to \{0,1\}$ then cardinality of $f$

(a) always finite (b) countable infinite
(c) uncountable (d) none of these

16. Which of the following sets are uncountable?

(a) Set of all constant sequences over $\mathbb{N}$
(b) Set of all sequences over $\{6,7\}$
(c) Set of all roots of any real polynomial $p \in \mathbb{R}[x]$.
(d) None of these

17. Let $X_1 = (0,1) \cap \mathbb{Q}$ and $X_2 = \left\{ \frac{p}{q} \in X_1 : q = 2^i, i \in \mathbb{N} \right\}$ then.

(a) $X_1$ is countable but $[0,1] - X_2$ is uncountable.
(b) $X_2$ is countable but $[0,1] - X_1$ is uncountable.
(c) $X_1$ is countable but $X_2$ is uncountable.
(d) $X_1$ is uncountable but $X_2$ is countable.

18. Set of all circles with centre at a rational coordinates and rational radii are

(a) Countable but infinite
(b) Uncountable
(c) Finite
(d) Can't be determined

19. Set $A, B \subset \mathbb{R}$ and $|A| = \lambda$ and $|B| = \mu$ then, which of the following are correct.

(a) If $A, B$ are disjoint then $|A \cup B| = \lambda + \mu$
(b) $|A \cup B| = \lambda + \mu$ always
(c) There exist $A, B$ such that $A \cap B \neq \phi$ but $|A \cup B| = \lambda + \mu$
(d) If $A$ is countable $\Rightarrow A^c$ is countable

20. Let $\#(A)$ denotes the cardinality of $A$ and if $f : A \to B$ be a function. Then which of following is/are correct?

(a) If $\#(A)$ is finite $\Rightarrow \#(f(A))$ is finite.
(b) If $\#(A)$ is uncountable $\Rightarrow \#(f(A))$ is uncountable
(c) If $\#(A)$ is uncountable $\Rightarrow \#(f(A))$ may be countably infinite.
(d) None of these

21. Let $\phi \neq A \subseteq \mathbb{R}$ and $A[x]$ be set of all polynomial with coefficient from $A$.

(a) If $A$ is finite $\Rightarrow A[x]$ finite.
(b) If $A$ infinite $\Rightarrow A[x]$ infinite.
(c) If $A$ infinite $\Rightarrow A[x]$ countable.
(d) If $A[x]$ is countable $\Rightarrow A$ similar to $\mathbb{N}$

22. Which of the following is correct. Let $A, B, C$ are any three set $f : A \to B, g : C \to A$ are function then

(a) If $f$ is $1-1$ & $g$ is onto and $C$ is countable $\Rightarrow A$ & $B$ both are countable.
(b) If $f$ is $1-1$ & range $(g)$ is uncountable $\Rightarrow A$ & $B$ uncountable
(c) If $g$ is onto, and $A$ is countable $\Rightarrow B$ & $C$ countable.
(d) If $f$ is onto, $g$ is $1-1$ and $A$ is countable $\Rightarrow B$ & $C$ countable

23. If $A$ and $B$ are non empty define $B^A = \{ f \mid f : A \to B$ functions$\}$ and $A^B = \{ f \mid f : B \to A$ functions$\}$, Then

(a) If $B^A$ & $A^B$ Countable $A$ & $B$ both countable.
(b) If $A^B$ Countable $\Rightarrow A$ finite & $B$ countable.
(c) If $A$ countable & $B$ finite $\Rightarrow A^B$ is countable.
(d) If $A$ finite & $B$ countable $\Rightarrow A^B$ is countable.

24. Let $A_1 = \{ f \mid f : A \to B, f$ is one-one function$\}$ and $A_2 = \{ f \mid f : A \to B, f$ is onto function$\}$ where $A$ & $B$ are non-empty sets. Then

(a) If $A=\mathbb{N}$ & $B$ is finite $\Rightarrow A_1$ countable.

(b) If $A$ finite & $B=\mathbb{N} \Rightarrow A_1$ countable.

(c) If $A=\mathbb{N}$ & $B$ is finite $\Rightarrow A_2$ countable.

(d) If $A$ is finite & $B=\mathbb{N} \Rightarrow A_2$ countable.

25. Which of the following sets are uncountable.

(a) $\mathbb{Q}^c \bigcap (a,b), \forall a,b \in \mathbb{R}$ where $a<b$

(b) Every subsets $A$ of $\mathbb{R}$ such that $A \bigcap \mathbb{Q} = \phi$

(c) $\mathbb{R}-A$, where $A \cap \mathbb{Q}^c = \phi$

(d) If $A=\{a | P(a) \neq 0, \forall P(x) \in Q[x]\}$ then $A \cap Q^c$

26. Which of the following is\are correct?

(a) If range of function uncountable $\Rightarrow$ domain of function uncountable.

(b) If set of function from $\mathbb{R} \to A$ is uncountable $\Rightarrow |A| \geq 2$

(c) Set of function from $A \to P(A)$ is uncountable if $A$ is infinite

(d) Set of function from $P(A) \to A$ either finite or uncountable, where $A$ non-empty

27. Let $A$ be any infinite set, $B$ is subset of $A$ then

(a) $A-B$ countable if $A$ countable & $B$ countable.

(b) $A-B$ is uncountable if $A$ uncountable & $B$ countable.

(c) $A-B$ is countably infinite & $A \neq B \Rightarrow A$ is countably infinite.

(d) $A-B$ is countably infinite & $B$ countable $\Rightarrow A$ countable.

28. Which of following statement is true?

A) $\exists$ a set $A \subseteq \mathbb{R}$ such that power set of $A$ is similar to $\mathbb{N}$.

B) All finite subset of $\mathbb{N}$ is uncountable.

C) Collection of all infinite subset of $\mathbb{N}$ is uncountable.

D) Collection of all disjoint sets in $\mathbb{R}$ is uncountable.

29. $A=\{(x,y) \in \mathbb{R}^2 | x \geq 0, y \geq 0\}$ & $B=(0,1)$, then which of the following is/are true?

A) $\exists$ a bijection from $A$ to $B$.

B) $\exists$ only injection from $A$ to $B$.

C) $\exists$ only surjection from $A$ to $B$.

D) None of these

30. which of the following statement is incorrect?

A) A set $A$ is infinite iff $A$ contains countable infinite set.

B) A set $A$ is finite iff $A$ is not similar to any of its proper subsets.

C) A set $A$ is infinite iff $A$ is similar to a proper subset of $A$.

D) None of these

31. Number of statements from following statements which are true?

1) If $B$ is an uncountable set and $A$ is countable set then $(B-A)$ is an uncountable set.

2) Family of all finite subsets of a countable set is countable.

3) The family of all subsets of countably infinite set is uncountable.

4) Set of all circles whose centres and radius are rational numbers is countable.

A) One B) Two C) Three D) Four

32. Let $C \subseteq [0,1]$ be uncountable and let $A$ be the set of all values of $a \in (0,1)$ such that $C \cap [a,1]$ is uncountable. Define $\alpha = Sup\ A$. Is $C \cap [\alpha,1]$ also uncountable?

33. A function $f:\mathbb{R} \to \mathbb{R}$ is given. Whenever we choose real numbers $a<b$ and set $\{f(x): a<x<b\}$ has a biggest element, we call this element local maximum of function $f$. Then the set of all local maximums of function $f$ is countable or uncountable?

34. If $f:\mathbb{R} \to \mathbb{R}$ is a function, $S \subseteq \mathbb{R}$, $S$ is countable and $T \subseteq \mathbb{R}$, $T$ is uncountable set, then

(a) $f(S)$ is countable if $f$ is one-one.

(b) $f(S)$ is countable if $f$ is not one-one.

(c) $f(T)$ is countable if $f$ is one-one.

(d) $f(T)$ is countable if $f$ is not one-one.

35. If $P=\{f | f=[0,1] \to \mathbb{N}\ is\ a\ function\}$. Define $w(f)=\inf\{f(x) | x \in [0,1]\} - \sup\{f(x) | x \in [0,1]\}$ which of the following statement is true for the

sets $S_1=\{f\in P|w(f)\ge 0\}$,

$S_2=\{f\in P|w(f)\le 0\}$, $S_3=\{f\in P|w(f)=0\}$

(a) $S_1,S_2$ and $S_3$ are uncountable.

(b) $S_1$ and $S_2$ are uncountable but $S_3$ is countable.

(c) $S_1$ and $S_3$ are countable but $S_2$ is uncountable.

(d) $S_2$ and $S_3$ are countable but $S_1$ is uncountable.

36. If $X=$set of all real numbers

$Y=$ set of all intervals in $\mathbb{R}$ with rational end points.

$Z=$set of all functions on $[0,1]$

$W=$ set of all continuous functions on $[0,1]$

If $|A|$ denotes cardinality of $A$ for any set $A$. Then which of the following is correct?

(a) $|X|=|Y|=|Z|=|W|$

(b) $|Y|<|W|<|Z|$

(c) $|Y|<|X|<|W|<|Z|$

(d) $|X|<|W|<|Z|$ **ARCHIVES**

37. Let X be a connected subset of real numbers. If every element of X is irrational , then the cardinality of X is . **( Net Dec. 2011)**

(a)Infinite (b) Countable infinite

(c) 2 (d) 1

38. Let $X$ denote the two-point set $\{0,1\}$ and write $X_j=\{0,1\}$ for every $j=1,2,3,....$ Let $Y=\prod_{j=1}^{\infty}X_j$.

Which of the following is/are

(a) $Y$ is countable set

(b) Card $Y$ = card $[0,1]$

(c) $\bigcup_{n=1}^{\infty}\left(\prod_{j=1}^{n}X_j\right)$ is countable

(d) $Y$ is uncountable **(NET JUNE 2011)**

39. Let $A=\{x^2:0<x<1\}$ and $B=\{x^3:1<x<2\}$ which of the following statements is true.

(a) There is a one to one, onto function from $A$ to $B$

(b) There is no one to one, onto function from $A$ to $B$ taking rational to rationals.

(c) There is no one to one function from $A$ to $B$ which is onto.

(d) There is no onto function from $A$ to $B$ which is one to one. **(NET JUNE 2011)**

40. For each $j=1,2,3,....$ let $A_j$ be a finite set containing at least two distinct elements. Then

(a) $\bigcup_{j=1}^{\infty}A_j$ is countable set

(b) $\bigcup_{n=1}^{\infty}\prod_{j=1}^{n}A_j$ is uncountable

(c) $\prod_{j=1}^{\infty}A_j$ is uncountable

(d) $\bigcup_{j=1}^{\infty}A_j$ is uncountable **( NET JUNE 2012)**

41. Consider the two serts $A=\{1,2,3\}$ and $B=\{1,2,3,4,5\}$. choose the correct statement .

(a)The total number of functions from A to B is 125

(b) The total number of function from A to B is 243

(c) The total number of one – to – one function from A to B is 60

(d) The total number of one – to – one functions from A to B is 120 **(Net June 2013 )**

42. Which of the following subsets of $\mathbb{R}^2$ are uncountable?

(a) $\{(a,b)\in\mathbb{R}^2|a\le b\}$

(b) $\{(a,b)\in\mathbb{R}^2|a+b\in\mathbb{Q}\}$

(c) $\{(a,b)\in\mathbb{R}^2|ab\in\mathbb{Z}\}$

(d) $\{(a,b)\in\mathbb{R}^2|a,b\in\mathbb{Q}\}$ **( NET DEC. 2013)**

43. Consider the following sets of function on $\mathbb{R}$

W= The set of constant function on $\mathbb{R}$

X= The set of polynomial function on $\mathbb{R}$

Y= The set of continuous function on $\mathbb{R}$

Z= The set of all function on $\mathbb{R}$

Which of these sets has the same cardinality as that of $\mathbb{R}$

(a)Only W

(b) Only W and X

(c) Only W, X and Z

(d) all of W,X,Y and Z **( Net June 2014)**

44. The number of surjective maps from a set of 4

elements to set of 3 elements is.

(a)36 (b)64

(c) 69 (d) 81 **(Net Dec. 2014)**

45. Which of the following sets of function are uncountable? ($\mathbb{N}$ stands for the set of natural numbers.) **( NET JUNE 2015)**

(a) $\{f | f : \mathbb{N} \to \{1,2\}\}$

(b) $\{f | f : \{1,2\} \to \mathbb{N}\}$

(c) $\{f | f : \{1,2\} \to \mathbb{N}, f(1) \le f(2)\}$

(d) $\{f | f : \mathbb{N} \to \{1,2\}, f(1) \le f(2)\}$

46. Consider the sets of sequence $X = \{(x_n) : x_n \in \{0,1\}, n \in \mathbb{N}\}$ and $Y = \{(x_n) \in X : x_n = 1$ for at most finitely many $n\}$.

Then **( NET JUNE 2016)**

(a) $X$ is countable, $Y$ is finite.

(b) $X$ is uncountable, $Y$ is countable.

(c) $X$ is countable, $Y$ is countable.

(d) $X$ is uncountable, $Y$ is uncountable.

47. Let $A$ be any set. Let $P(A)$ be the power set of $A$, that is, the set of all subsets of $A; P(A) = \{B : B \subseteq A\}$. Then which of the following is/are true about set $P(A)$?

(a) $P(A) = \Phi$ for some $A$.

(b) $P(A)$ is a finite set for some $A$

(c) $P(A)$ is a countable set for some $A$.

(d) $P(A)$ is a uncountable set for some $A$

**(NET JUNE 2016)**

48. Let $p(x) = \alpha x^2 + \beta x + \gamma$ be a polynomial

$S = \{(a,b,c) \in \mathbb{R}^3 : p(x) = a(x - x_0)^2 + b(x - x_0) + c$

for all $x \in \mathbb{R}$ where $\alpha, \beta, \gamma \in \mathbb{R}$. Then the number of elements in $S$ is.

(a) 0

(b) 1

(c) strictly greater then 1 but finite

(d) infinite **( NET JUNE 2017)**

49. For a set $X$, let $P(X)$ be the set of all subsets of $X$ and let $\Omega(X)$ be the set of all function $f : X \to \{0,1\}$. Then.

(a) If $X$ is finite then $P(X)$ is finite

(b) If $X$ and $Y$ are finite sets and if there is a 1-1 correspondence between $P(X)$ and $P(Y)$ then there is a 1-1 correspondence between $X$ and $Y$.

(c) There is no 1-1 correspondence between $X$ and $P(X)$.

(d) There is a 1-1 correspondence between $\Omega(X)$ and $P(X)$. **( NET DEC 2017)**

50. Let $S = \left\{(x,y) \middle| x^2 + y^2 = \frac{1}{n^2}\right.$ where $n \in \mathbb{N}$ and either $x \in \mathbb{Q}$ or $y \in \mathbb{Q}\}$ here $\mathbb{Q}$ is set of rational numbers and $\mathbb{N}$ is the set of positive integers. Which of the following is true?

(a) $S$ is a finite non empty set

(b) $S$ is countable

(c) $S$ is uncountable

(d) $S$ is empty **( NET JUNE 2018)**

51. Which of the following sets are uncountable?

(a) The set of all function from $\mathbb{R}$ to $\{0,1\}$

(b) The set of all function from $\mathbb{N}$ to $\{0,1\}$

(c) The set of all finite subsets of $\mathbb{N}$

(d) The set of all subsets of $\mathbb{N}$ **(NET JUNE 2018)**

52. Let $S$ be an infinite set. Which of the following statements are true?

(a) If there is an injection from $S$ to $\mathbb{N}$, then $S$ is countable.

(b) If there is a surjection from $S$ to $\mathbb{N}$ then $S$ is countable.

(c) If there is an injection from $\mathbb{N}$ to $S$ then $S$ is countable.

(d) If thsere is a surjection from $\mathbb{N}$ to $S$, then $S$ is countable. **(NET DEC 2018)**

53. Which of the following sets is uncountable?

(a) $\left\{x \in \mathbb{R} \middle| \log(x) = \frac{p}{q} \text{ for some } p,q \in \mathbb{N}\right\}$

(b) $\left\{x \in \mathbb{R} \middle| (\cos(x))^n + (\sin(x))^n = 1 \text{ for some } n \in \mathbb{N}\right\}$

(c) $\left\{x \in \mathbb{R} \middle| x = \log\left(\frac{p}{q}\right) \text{ for some } p, q \in \mathbb{N}\right\}$

(d) $\left\{x \in \mathbb{R} \middle| \cos(x) = \frac{p}{q} \text{ for some } p, q \in \mathbb{N}\right\}$

**( NET JUNE 2019)**

54. Which of the following sets is countable ?
 (a) The set of all functions from $\mathbb{Q}$ to $\mathbb{Q}$
 (b) The set of all functions from $\mathbb{Q}$ to $\{0,1\}$
 (c) The set of all functions from $\mathbb{Q}$ to $\{0,1\}$ which vanish outside a finite set.
 (d) The set of all subsets of $\mathbb{N}$ **( NET Dec. 2019)**

55. Let $S$ be the set of all sequence $\{a_1, a_2, ......., a_n, .....\}$ where each entry $a_i$ is either 0 or 1. Then $S$ is countable ......... (T/F) **(TIFR 2012)**

56. Which of the following sets are countable?
 (a) The set of all algebraic numbers
 (b) The set of all strictly increasing infinite sequences of positive integers
 (c) The set of all infinite sequence of integers which are in arithmetic progression. **(NBHM 2016)**

57. Let $A =$ the set of all sequences of real numbers $B =$ the set of all sequences of positive real numbers, $C = C[0,1]$ and $D = \mathbb{R}$ Which of the following statements are true?
 (a) All the four sets have the same cardinality
 (b) $A$ and $B$ have the same cardinality
 (c) $A, B$ and $D$ have the same cardinality, which is different from that of $C$. **(NBHM - 2013)**

58. Determine if the following collections are countable or uncountable.
 (a) The collection of all finite subsets of $\mathbb{N}$
 (b) The collection of all infinite sequence of positive integers
 (c) The collection of all roots of all polynomials in one variable, with integer coefficients.

**(NBHM 2011)**

59. Let $X$ be a countably infinite subset of $\mathbb{R}$ and $A$ be a countably infinite subsets of $X$. Then the set $X \setminus A = \{x \in X | x \notin A\}$
 (a) Is empty
 (b) Is a finite set
 (c) Can be a countably infinite set
 (d) Can be an uncountable set **(DU 2016)**

60. An algebraic number is a root of a polynomial whose coefficients are rational. The set of algebraic numbers is
 (a) finite (b) countably infinite
 (c) uncountable (d) none of these

**(DU 2014)**

61. Let $A_n$ and $B_n, n \in \mathbb{N}$ be nonempty subsets of $\mathbb{R}$ such that $A_1 \supseteq A_2 \supseteq ....$ and $B_1 \subseteq B_2 \subseteq B_3 \subseteq ....$ Let the cardinality of $A_n$ be $a_n$ and the cardinality of $B_n$ be $b_n$. Then the cardinality of
 (a) $\bigcup_{n=1}^{\infty} B_n$ is $\lim_{n\to\infty} b_n$ (b) $\bigcup_{n=1}^{\infty} B_n$ is $\max_n b_n$
 (c) $\bigcap_{n=1}^{\infty} A_n$ is $\lim_{n\to\infty} a_n$ (d) $\bigcap_{n=1}^{\infty} A_n$ is $\max_n a_n$

**(HU 2011)**

62. Let $q > 1$, be positive integer then the set $\left\{\left(\cos\frac{\pi}{q} + i\sin\frac{\pi}{q}\right)^n : n = 0,1,2,3,.....\right\}$ where $i = \sqrt{-1}$ is.
 (a) A singleton
 (b) A finite set but not a singleton
 (c) A countable infinite set
 (d) Dense on the unit circle **(IISC Phd 2006)**

63. Which of the following is/are correct.
 (a) $(0,1)$ is similar to $\mathbb{R}$
 (b) $(0,1)$ is similar to $\mathbb{R}^+$
 (c) $(0,1)$ is similar to $[0,1]$
 (d) $[a,b]$ is similar to $(a,b)\ \forall a,b \in \mathbb{R}$ where $a < b$

64. Let $X = \{(x,y) | 0 \le x \le 1\}$ and $Y = \{(x,y) | 0 \le x < 1, y = 0\}$ then
 (a) $X$ is similar to $Y$
 (b) $Y$ is similar to $\mathbb{R}$
 (c) $X$ is similar to $\mathbb{R}$
 (d) $X$ is similar to $\mathbb{N} \times \mathbb{R}$

65. Let $A$ be any set then.
 (a) $A$ is similar to $A \times A$ for any $A$