ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.

M.Sc. (BIOINFORMATICS)

COURSE CODE : 378

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 378

Time : 2 Hours Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. At the end of 20 cycles of PCR there are $10*10^{11}$ molecules. How many DNA molecules would be there at the end of 18 cycles?

(A) $25*10^{10}$ (B) $2.5*10^{12}$

(C) $5*10^{11}$ (D) none of the above

2. An amino acid of pI 5 is kept in buffer of pH 2. To which electrode will this amino acid move?

(A) anode (B) cathode

(C) it will not move since it s neutral (D) none of the above

3. If there are six nucleotide bases possible instead of four. What is the maximum number of different amino acids that can be encoded by the same three letter codon?

(A) 216 (B) 640 (C) 96 (D) 540

4. The DNA from the bacteriophage Phi X174 has a base composition of 25% A, 33% T, 24% G, and 18% C. Which of the following best explains this observation?

(A) viral genome does not follow Watson-Crick base pairing rule

(B) lack of efficient DNA repair machinery in virus

(C) the genome of bacteriophage Phi X174 is single-stranded.

(D) all of the above

5. Three dice are thrown simultaneously. What is the probability that all three dice would be different?

(A) 5/9 (B) 7/9 (C) 20/216 (D) 50/216

6. If n is defined as the sum of the numbers appearing when two dices are thrown simultaneously, which of the following events has the highest probability of occurrence?

(A) n= 4 (B) n=7 (C) n=12 (D) n=9

7. The space factor when determining the efficiency of the algorithm is measured by

(A) computing the maximum memory needed by the algorithm

(B) computing the minimum memory needed by the algorithm

(C) computing the average memory needed by the algorithm

(D) computing the maximum disk space needed by the algorithm

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8. Suppose that a certain bioinformatics software has a mean time between failures of 10,000 hours and has a mean time to repair of 20 hours. If the software is used by 100 customers, what is its availability?

(A) 80 % (B) 90 % (C) 98 % (D) 99.8 %

9. Which of the following is NOT an assumption of the Binomial distribution?

(A) The probability of success is equal to 0.5 in all trials

(B) The number of successes in the trials is counted

(C) All trials must be identical

(D) All trials must be independent

10. The complexity of linear search algorithm and Bubble sort algorithm is

(A) O(n) and O(n^2) (B) 2O(n) and O(n^3)

(C) O(n) and O(n^1) (D) O(n) and O(n^4)

11. The time factor when determining the efficiency of algorithm is measured by

(A) Counting microseconds

(B) Counting the number of key operations

(C) Counting the number of statements

(D) Counting the kilobytes of algorithm

12. If every node u in G is adjacent to every other node v in G, A graph is said to be

(A) isolated (B) complete

(C) finite (D) strongly connected

13. CLUSTAL performs search based on

(A) global sequence alignment (B) progressive sequence alignment

(C) local sequence alignment (D) None of these

14. Monte Carlo simulation is a method for iteratively evaluating a

(A) deterministic model (B) stochastic model

(C) both (A) and (B) (D) none of the above

15. Expect threshold for searching of primer using BLAST should close to

(A) 0 (B) 1

(C) 10 (D) 1000

16. Alignment of protein structures can be done by following

(A) Dynamic programming (B) Distance matrix

(C) None of these (D) both (A) and (B)

17. The main feature of any phylogenetic tree is

(A) Clades (B) Roots

(C) Topology (D) Alignment

18. The melting temperature, T_m of DNA depends on

(A) Nature of the solvent

(B) The concentration of ions in solution

(C) The pH

(D) All the above

19. The various DNA bands in a gel can be stained by

(A) Planar aromatic cations (B) Non-planar aromatic cations

(C) Planar aromatic anions (D) Non-planar aromatic anions

20. The main function of release factor, RF-1 in E.coli protein synthesis is

(A) Recognizes UAA and UAG stop codons

(B) Recognizes UAA and UGA stop codons

(C) Displaces GDP from EF-Tu

(D) GTP hydrolysis

21. The word SMILES stands for

(A) Simplified Molecular Input Line Electron Specification

(B) Simplified Molecular Input Line Entry Specification

(C) Symmetrical Molecular Input Line Entry Specification

(D) Symmetrical Molecular Input Line Electron Specification

22. Translation is initiated and terminated by which of the following pair of codon respectively?

(A) UAA and AUG (B) AUG and UAG

(C) UGA and UAA (D) UAG and UCU

23. A glass rod rubbed with silk acquires a charge of 8 × 10–12C. The number of electrons it has gained or lost

(A) 5×10^{-7} (gained) (B) 5×10^{7} (lost)

(C) 2×10^{-8} (lost) (D) -8×10^{-12} (lost)

24. The electrostatic force between two point charges kept at a distance d apart, in a medium $\varepsilon r = 6$, is 0.3 N. The force between them at the same separation in vacuum is

(A) 20 N (B) 0.5 N (C) 1.8 N (D) 2 N

25. Electric field intensity is 400Vm-1 at a distance of 2m from a point charge. It will be 100 Vm-1 at a distance?

(A) 50 cm (B) 4 cm (C) 4 m (D) 1.5 m

26. Two point charges +4q and +q are placed 30 cm apart. At what point on the line joining them the electric field is zero?

(A) 15cm from the charge q (B) 7.5cm from the charge q

(C) 20cm from the charge 4q (D) 5cm from the charge q

27. A dipole is placed in a uniform electric field with its axis parallel to the field. It experiences

(A) only a net force (B) only a torque

(C) both a net force and torque (D) neither a net force nor a torque

28. If a point lies at a distance x from the midpoint of the dipole, the electric potential at this point is proportional to

(A) $1/x^2$ (B) $1/x^3$

(C) $1/x^4$ (D) $1/x^{3/2}$

29. Electric potential energy (U) of two point charges is

(A) $q_1q_2/4\pi\varepsilon_0r^2$ (B) $q_1q_2/4\pi\varepsilon_0r$

(C) $pE\cos\theta$ (D) $pE\sin\theta$

30. The work done in moving 500μC charge between two points on equipotential surface is

(A) zero (B) finite positive

(C) finite negative (D) infinite

31. Which of the following quantities is scalar?

(A) dipole moment (B) finite positive

(C) electric field (D) electric potential

32. The unit of permittivity is

(A) $C^2N^{-1}m^{-2}$ (B) Nm^2C^{-2}

(C) Hm^{-1} (D) $NC^{-2}m^{-2}$

33. The capacitance of a parallel plate capacitor increases from 5 μf to 60 μf when a dielectric is filled between the plates. The dielectric constant of the dielectric is

(A) 65 (B) 55 (C) 12 (D) 10

34. A hollow metal ball carrying an electric charge produces no electric field at points

(A) outside the sphere (B) on its surface

(C) inside the sphere (D) at a distance more than twice

35. A charge of 60 C passes through an electric lamp in 2 minutes. Then the current in the lamp is

(A) 30 A (B) 1 A (C) 0.5 A (D) 5 A

36. A toaster operating at 240V has a resistance of 120Ω. The power is

(A) 400 W (B) 2 W (C) 480 W (D) 240 W

37. In the case of insulators, as the temperature decreases, resistivity

(A) decreases (B) increases

(C) remains constant (D) becomes zero

38. According to Faraday's law of electrolysis, when a current is passed, the mass of ions deposited at the cathode is independent of

(A) current (B) charge

(C) time (D) resistance

39. Phosphor-bronze wire is used for suspension in a moving coil galvanometer, because it has

(A) high conductivity (B) high resistivity

(C) large couple per unit twist (D) small couple per unit twist

40. Industrial melanism is an example of :

(A) directional selection (B) progressive selection

(C) diversifying selection (D) disruptive selection

41. Dead space means:

(A) no space

(B) temporary cessation of breathing

(C) space where gaseous exchange takes place

(D) space where gaseous exchange does not occur

42. Okazaki fragments give rise to:

(A) master strand (B) sense strand

(C) lagging strand (D) leading strand

43. tRNA carries amino acid on the site known as:

(A) 5' end (B) 3' end

(C) anticodon (D) aminoacyl synthetase binding loop

44. The attachment site for RNA polymerase on the DNA template is called:

(A) cistron (B) regulator

(C) operator (D) promoter

45. The pH of a 0.001 M acid solution is:

(A) 1 (B) 2 (C) 3 (D) 4

46. Which of the following is coded by the least number of codons?

(A) glycine (B) histidine

(C) methionine (D) serine

47. Osteoporosis results from lesser calcium in bones. This may be due to

(A) hyperactivity of both thyroid and parathyroid glands

(B) hypoactivity of both thyroid and parathyroid gland

(C) hypoactivity of thyroid and hyperactivity of parathyroid gland

(D) hyperactivity of thyroid and hypoactivity of parathyroid gland

48. Histamines, the chemicals that initiate inflammation reaction at a location within the body are released by:

(A) mast cells in areolar tissue (B) mucosal cells of capillaries

(C) glial cells in nervous tissue (D) fibroblasts in connective tissue

49. Among the following, which DNA is the most conserved?

(A) mitochondrial DNA (B) chloroplast DNA

(C) r DNA (D) DNA coding for t-RNA.

50. Among the following, the molecule that would experience least resistance for entering a cell would be:

(A) NaCl (B) glucose

(C) fatty acid (D) amino acid

51. How many amino acids would be in an oligopeptide result from m-RNA sequence given below?

5'UGGCCTAUGCACAGGUAGACCTAG 3'

(A) 7 amino acids (B) 8 amino acids

(C) 4 amino acids (D) 3 amino acids

52. The organelle having high level of acid phosphatase activity is:

(A) Lysosomes (B) Smooth ER

(C) Rough ER (D) mitochondria

53. Polymerase chain reaction needs a thermostable DNA polymerase isolated from a bacterium known as:

(A) Thermus thermus
(B) Thermus aquaticus
(C) Thermus marina
(D) Thermus namibiensis

54. Body secretions mostly contain:

(A) IgM (B) IgA (C) IgD (D) IgG

55. DNA fingerprinting is based on detection of:

(A) Variable number of tandem alleles
(B) Variable number of tandem repeats
(C) Variable number of tandem loci
(D) Constant number of tandem loci

56. Most common buffer in blood is:

(A) bicarbonate
(B) phosphate
(C) carbonate
(D) biphosphate

57. Most simplest amino acid is:

(A) Lysine
(B) Glycine
(C) Leucine
(D) Isoleucine

58. The Km (Michaelis constant) of an enzyme for a substrate is defined as:

(A) dissociation constant of the enzyme-substrate complex
(B) dissociation constant of the enzyme product complex
(C) half substrate concentration at which reaction rate is maximal
(D) substrate concentration at which reaction rate is half maximal

59. Homologous genes have:

(A) Highly similar sequence
(B) Highly distinct sequence
(C) A common ancestral gene
(D) Distinct ancestral genes

60. Two forces represented by $(2\,\mathbf{i} - 7\,\mathbf{j} + 7\,\mathbf{k})$ and $(-2\,\mathbf{i} + 7\,\mathbf{j} - 16\,\mathbf{k})$ act on a body. The magnitude of the resultant force acting on the body will be

(A) 9 (B) 125 (C) $\sqrt{125}$ (D) 3

61. A 50 kg person is standing in an elevator moving upward with an acceleration of 5 ms^{-2}. The force that the person exerts on the floor of elevator (assuming the value of g as 10 ms^{-2}) is :

(A) 625 N (B) 10 N (C) 250 N (D) 6250 N

62. Some negative charge is given to a pith ball. As compared to a neutral pith ball, the charged pith ball will consist of

(A) more electrons (B) less electrons

(C) same number of electrons (D) no electrons.

63. If a partially filled hollow cylinder is completely filled with water its centre of mass

(A) moves down (B) moves up

(C) does not change (D) moves towards one wall

64. Which of the following is a scalar?

(A) kinetic energy (B) electric field intensity

(C) acceleration (D) linear momentum.

65. With decrease in temperature, the frictional force acting between two surfaces

(A) decreases (B) increases

(C) remains the same (D) may increase or decrease

66. The temperature scale that will read only positive values is :

(A) Centigrade scale (B) Fahrenheit scale

(C) Kelvin scale (D) Reaumer scale

67. $\nabla . (\nabla \times A) =$ (where ∇ is the standard del operator and A is a vector)

(A) 0 (B) $\nabla (\nabla . A)$ (C) $\nabla . A$ (D) $\nabla \times A$

68. In a square matrix, if each diagonal element is zero and $a_{ij} = - a_{ji}$, then the matrix is

(A) Hermitian (B) Skew-Hermitian

(C) Symmetric (D) Skew-symmetric

69. According to Kepler's third law, the period of a planet is proportional to

(A) R3/2 (B) $R^{2/3}$ (C) R^2 (D) R^3

70. If a position vector of a particle is determined by $r = (t^3+t)\ i - 2t\ j + 3\ k$, then the magnitude of acceleration of the particle after 3 seconds is

(A) 18 units (B) 9 units (C) 26 units (D) 30 units

71. The potential energy of a capacitor of capacitance C, having a charge of q and a potential difference of V is

(A) (CV2)/2 (B) $(Vq^2)/2$

(C) $(VC^2)/2$ (D) $(qC^2)/2$

72. The vector potential at the position defined by vector r in a uniform magnetic field is given by

(A) B X r (B) (B X r) / 2

(C) (B X r)/(B.r) (D) (B X r) B.r

73. The direction of grad Φ is

(A) in the direction of surface Φ

(B) in the direction normal to surface Φ

(C) at an angle of 45° to the surface Φ

(D) tangential to the surface Φ

74. As the wavelength of the light decreases, the resolving power of a diffraction grating

(A) increases (B) decreases

(C) will not change (D) becomes 0

75. The Heisenberg uncertainty principle will not talk about uncertainties in

(A) position (B) energy

(C) charge (D) momentum

76. Assuming that moving with same velocity, which of the following will have higher de Broglie's wavelength

(A) electron (B) proton

(C) neutron (D) α-particle

77. De Broglie's hypothesis is associated with wave nature of

(A) electrons only (B) α-particles only

(C) radiations (D) all material particles

78. A free particle can carry any amount of energy and so its energy is

(A) continuous
(B) degenerate
(C) discrete
(D) neither continuous nor discrete

79. A laser beam consists of

(A) lighter material particles
(B) electrons
(C) protons
(D) photons

80. Which of the following gives correct correlation between wave number and wave length

(A) Wavenumber = 1/wavelength in nm
(B) Wavenumber = 1/wavelength in cm
(C) Wavenumber = wavelength in m^{-1}
(D) Wavelength in nanometers = 1/wavenumber

81. What is the possible number of mode of vibration for linear molecule in IR region

(A) 3n-4 modes
(B) 3n-5 modes
(C) 3n-6 modes
(D) 2n-6 modes

82. Chemical shift is defined by the signal with respect to

(A) The signal of tetramethylsilane
(B) The signal of CO2
(C) The signal of trichloromethane
(D) The signal of choloroform

83. In NMR spectra spin-spin splitting follows

(A) N+0 rule
(B) N+1 rule
(C) N+2 rule
(D) N+3 rule

84. In the constructive interference the amplitude of wave is equal to

(A) The amplitude of single wave
(B) The amplitude of both wave
(C) The amplitude of both wave and phase angle 0°
(D) The amplitude of both wave and phase angle 90°

85. How can you change Na to Na^+

(A) By adding one electron
(B) By Adding one neutron
(C) By removing one electron
(D) By removing one proton

86. $^{12}C_6$ and $^{14}C_6$ are examples of carbon

(A) Molecules
(B) Valences
(C) Isotopes
(D) Ions

87. Which of the following has 8 protons and 10 electrons

(A) N^{3-}
(B) O^{2-}
(C) O^{3}
(D) F^{-}

88. The process of forming curd is called

(A) Sublimation reaction
(B) Condensation reaction
(C) Fermentation reaction
(D) Reduction reaction

89. Who solved the structure of collagen

(A) Venki Ramakrishnan
(B) G.N. Ramachandran
(C) Sir. C.V. Raman
(D) Wim Hole

90. A messenger RNA is 666 nucleotides long, including the initiator and termination codons. The number of amino acids in the protein translated from this mRNA is

(A) 222 (B) 221 (C) 223 (D) 220

91. The R group found in amino acids consists of

(A) an amine group.
(B) a hydroxyl group.
(C) an amine group and a carboxyl group.
(D) at least a hydrogen atom

92. The empirical formula for carbohydrates is

(A) $(CH_2O)_n$
(B) $2(CHO)_n$
(C) $(C_2HO)_n$
(D) $(CHO)_2$

93. The protein surface tends to be more _____ than the inner core.

(A) hydrophilic
(B) hydrophobic
(C) aromatic
(D) acidic

94. Transmembrane regions of membrane proteins are usually more

(A) Hydrophilic (B) Hydrophobic

(C) Acidic (D) Basic

95. Irregular heart beat is due to the deficiency of

(A) Copper (B) Magnesium

(C) Potassium (D) Sodium

96. The median of the following data :

5, 8, 11, 8, 10, 16, 13, 8, 10, 7

(A) 10 (B) 9 (C) 8 (D) 7

97. The mode of the following data:

3, 8, 5, 4, 7, 2, 9

(A) 5.4 (B) 4.5

(C) 4 (D) Does not exist

98. The ozone layer is formed by the reaction of

(A) Oxygen and IR rays (B) Oxygen and chlorine

(C) Oxygen and carbon dioxide (D) Oxygen and UV rays

99. The value of is ${}^{6}C_{2}$

(A) 18 (B) 20

(C) 24 (D) 15

100. A box contains 6 red and 4 black balls. One ball is drawn, what is the probability that it is red?

(A) 3/5 (B) 2/5 (C) 1/5 (D) 1/10