

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

Ph.D. (BIOINFORMATICS)

COURSE CODE : 104

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 104

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. What is the difference between RefSeq and GenBank?
 - (A) RefSeq includes publicly available DNA sequences
 - (B) GenBank includes nonredundant curated data
 - (C) GenBank sequences are derived from RefSeq
 - (D) RefSeq sequences are derived from GenBank

2. The tool for identification of motif is
 - (A) COPIA
 - (B) Patternhunter
 - (C) PROSPECT
 - (D) BLAST

3. In Perl, scalar variables can contain
 - (A) Strings or numbers
 - (B) Strings, lists or numbers
 - (C) Strings, numbers or references
 - (D) Numbers, hashes or lists

4. The one aspect that is a part of the catalytic reaction mechanism of all enzymes is
 - (A) General acid-base catalysis
 - (B) Substrate strain
 - (C) Binding the transition state
 - (D) Covalent catalysis

5. The electrophoretic mobility shift assay determines
 - (A) If a specific genetic polymorphism is present in DNA
 - (B) If any genetic polymorphism is present in DNA
 - (C) Binding of protein to a specific DNA sequence
 - (D) The T_M of a DNA

6. Shortcut Notation for groups of four Binary Digits is called _____ Number System.
 - (A) Unicode
 - (B) Decimal
 - (C) Binary
 - (D) Hexadécimal

7. Which of the following protocol is not used in the Internet?
 - (A) Telnet
 - (B) WIRL
 - (C) HTTP
 - (D) Gopher

8. Which one of the following protein secondary structure prediction server is based on neural network?
 - (A) MZEF
 - (B) NNPredict
 - (C) Consurf
 - (D) DAS

9. Allosteric enzymes are commonly found in what metabolic regulatory system?
 - (A) Competitive inhibition
 - (B) Enzyme induction
 - (C) Feedback inhibition
 - (D) Regulatory inhibition

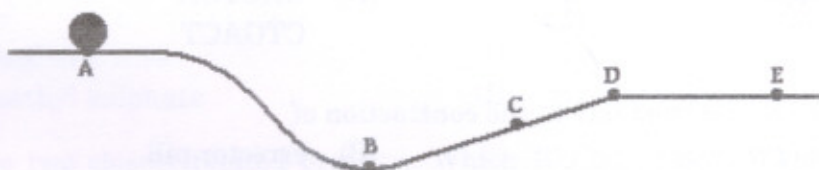
10. When interpreting the results of microarray, the degree of hybridization between a given probe and an organism to be identified is measured by
 (A) turbidity read in a spectrophotometer
 (B) color intensity of an image produced by scanning with a laser beam
 (C) length of the probe formed
 (D) degree of agglutination
11. The Lennard-Jones potential is commonly used to describe _____
 (A) Van der Waals force (B) Aromaticity
 (C) Hydrogen bond (D) Stacking
12. Conversion of a chemical structure from *.mol format to SMILES is “_____” type of file format conversion.
 (A) 3D to string (B) 3D to 2D
 (C) 2D to 3D (D) 1D to 3D
13. Which of the following is not an Input Device?
 (A) Touch Screen (B) Optical Scanners
 (C) Touch Pad (D) Mouse Pad
14. The protein surface tends to be more _____ than the inner core.
 (A) Hydrophobic (B) Hydrophilic (C) Acidic (D) Basic
15. What is the probability of getting at least 4 heads in 6 tosses of a fair coin?
 (A) $11/32$ (B) $11/12$ (C) $13/32$ (D) $1/4$
16. In how many ways can a committee of 5 people can be chosen out of 9 people?
 (A) 124 (B) 126 (C) 128 (D) 122
17. An airplane must have a minimum velocity of 100 ms^{-1} in order to take off. For a runway of 1000 m long, the minimum acceleration the airplane should have is
 (A) 5 ms^{-2} (B) 10 ms^{-2} (C) 50 ms^{-2} (D) 100 ms^{-2}
18. A car moving at a velocity of 20 ms^{-1} slows down to 10 ms^{-1} in 10 s. The acceleration of the car is
 (A) 2 m s^{-2} (B) -2 ms^{-2} (C) 1 m s^{-2} (D) -1 m s^{-2}
19. A boiled egg and a raw egg of same mass and size are made to rotate about their own axis. If I_b and I_r are moments of inertia of boiled egg and raw egg respectively, then
 (A) $I_b = I_r$ (B) $I_b > I_r$ (C) $I_b < I_r$ (D) $I_b = 2 I_r$

20. A car and lorry are moving with same momentum. If same brake force is applied then,
- (A) car comes to rest in shorter distance
 - (B) lorry comes to rest in shorter distance
 - (C) both travels the same distance before coming to rest
 - (D) insufficient data to draw any conclusion
21. If a stationary bomb explodes into two pieces of unequal masses, then
- (A) both will have the same kinetic energy
 - (B) bigger piece will have greater kinetic energy
 - (C) smaller piece will have greater kinetic energy
 - (D) bigger piece will have greater momentum
22. In the human brain, body temperature, metabolism, heart rate, sexual development, sleep and the body's use of fat and water are influenced by this region of the brain. This region of the brain is the:
- (A) hypothalamus
 - (B) midbrain
 - (C) corpus callosum
 - (D) cerebellum
23. From which grandparent or grandparents did you inherit your mitochondria? Is it your:
- (A) mother's parents
 - (B) paternal grandfather
 - (C) grand mothers
 - (D) maternal grandmother
24. Which of these sugars does not normally react with Benedict's reagent?
- (A) Fructose
 - (B) Galactose
 - (C) Glucose
 - (D) Sucrose
25. In a Lineweaver-burg plot of a simple enzymatic reaction, what is the value of the x-intercept at the $1/S$ axis?
- (A) K_m
 - (B) $1/K_m$
 - (C) $-K_m$
 - (D) $-1/K_m$
26. Which of the following properly describes the order of events in the processing of a typical eukaryotic gene?
- (A) Capping, Slicing and Polyadenylation
 - (B) Capping, Polyadenylation and Slicing
 - (C) Polyadenylation, capping and slicing
 - (D) Slicing, Ployadenylation andCapping
27. A mixture of proteins having different Molecular Weight (A- 11237, B: 66000, C: 42000, D: 90000) is loaded onto a gel filtration column that has a size exclusion limit of 75, 00Da. The proteins will elute from the column in the following order
- (A) A,B,C,D
 - (B) D,B,C,A
 - (C) A,C,B,D
 - (D) D,A,B,C

28. A synthetic mRNA of repeating sequence 5'-CACACACACACACAC.3' is used for a cell-free protein synthesizing system like the one used by Nirenberg. If we assume that protein synthesis can begin without the need for an initiator codon, what product or products would you expect to occur after protein synthesis?
- (A) one protein, consisting of a single amino acid
 (B) three proteins, each consisting of a different, single amino acid
 (C) two proteins, each with an alternating sequence of two different amino acids
 (D) one protein, with an alternating sequence of two different amino acids
29. In the Meselson-Stahl DNA replication experiment, what percent of the DNA was composed of one light strand and one heavy strand after one generation of growth in ^{14}N containing growth media?
- (A) 100 (B) 25 (C) 50 (D) 75
30. Under conditions where methionine must be the first amino acid, what protein would be coded for by the following mRNA?
 5'-CCUCAUAUGCGCCAUUAUAAGUGACACACA-3'
- (A) pro his met arg his tyr lys cys his thr
 (B) met arg his tyr lys cys his thr
 (C) met arg his tyr lys
 (D) met pro his met arg his tyr lys cys his thr
31. What is the next number in the series 1 4 10 22
- (A) 46 (B) 54 (C) 36 (D) 44
32. In what distribution mean, median and mode are equal?
- (A) Poisson (B) Binomial (C) Normal (D) Geometric
33. The study of relationship between two or more variables is called _____
- (A) Association (B) Regression
 (C) Correlation (D) Histogram
34. What is the test used to test the equality of several means
- (A) t - test (B) Z - test (C) Anova (D) Chi-Square
35. α -helix in coiled coil has per turn
- (A) 3.5 residue (B) 3.6 residue
 (C) 3 residue (D) 3.4 residue
36. Ramachandran plot discusses about
- (A) Phi-Psi scatter diagram (B) Phi-Psi correlation diagram
 (C) Phi-Psi steric contour diagram (D) Phi-Psi energy diagram

37. Trypsin does not digest after Lys/Arg when the following residue is
 (A) Ala (B) His (C) Trp (D) Pro
38. Nobel prize awarded for an Indian to the new findings in
 (A) Change in nuclear spin
 (B) Ultraviolet-Visible radiation
 (C) Difference in light scattering than incident radiation
 (D) X-radiation for collagen
39. If 4-3-14-14 denotes BALL then what does 13-11-22-7 denote
 (A) KITE (B) JACK (C) KILL (D) TAIL
40. Phenol, when it first reacts with concentrated sulphuric acid and then with concentrated nitric acid, gives
 (A) 2,4,6-trinitrobenzene (B) o-nitrophenol
 (C) p-nitrophenol (D) nitrobenzene
41. α -D-(+)-glucose and β -D-(+)-glucose are
 (A) conformers (B) epimers
 (C) anomers (D) enantiomers
42. Amount of oxalic acid present in a solution can be determined by its titration with KMnO_4 solution in the presence of H_2SO_4 . The titration gives unsatisfactory result when carried out in the presence of HCl, because HCl
 (A) gets oxidised by oxalic acid to chlorine
 (B) furnishes H^+ ions in addition to those from oxalic acid
 (C) reduces permanganate to Mn^{2+}
 (D) oxidises oxalic acid to carbon dioxide and water
43. Which one of the following types of drugs reduces fever?
 (A) Analgesic (B) Antipyretic
 (C) Antibiotic (D) Tranquiliser
44. Due to the presence of an unpaired electron, free radicals are:
 (A) Chemically reactive (B) Chemically inactive
 (C) Anions (D) Cations
45. The highest electrical conductivity of the following aqueous solutions is of
 (A) 0.1M acetic acid (B) 0.1M chloroacetic acid
 (C) 0.1M fluoroacetic acid (D) 0.1M difluoroacetic acid

46. Two solutions of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5 M first solution + 520 mL of 1.2 M second solution. What is the molarity of the final mixture?
 (A) 1.20 M (B) 1.50 M (C) 1.344 M (D) 2.70 M
47. If we consider that $1/6$ in place of $1/12$ mass of carbon atom is taken to be the relative atomic mass unit, the mass of one mole of a substance will
 (A) Decrease twice
 (B) Increase two fold
 (C) Remain unchanged
 (D) Be a function of the molecular mass of the substance
48. Based on lattice energy and other considerations which one of the following alkali metal chlorides is expected to have the highest melting point?
 (A) LiCl (B) NaCl (C) KCl (D) RbCl
49. Enthalpy is the
 (A) change of electrical energy
 (B) change of magnetic energy
 (C) change of heat energy
 (D) change of magnetic energy and heat energy
50. Use the following diagram to answer question. Neglect the affect of resistance forces.



- As the object moves from point A to point D across the surface, the sum of its gravitational potential and kinetic energies ____.
- (A) decreases only (B) decreases and then increases
 (C) remains the same (D) increases and then decreases
51. Quantity electric potential is defined as the amount of
 (A) electric potential energy (B) force acting upon a charge
 (C) potential energy per charge (D) force per charge
52. The process in which DNA is constantly read out into a particular set of mRNA is called
 (A) translation (B) protein synthesis
 (C) DNA duplication (D) Transcription

53. The group of biologically important organic compounds responsible for storage and transfer of information is
 (A) Proteins (B) Nucleic acids
 (C) Polysaccharides (D) Phospholipids
54. Which one of the following have highest energy transition?
 (A) n to σ^* (B) σ to σ^* (C) n to Π^* (D) Π to Π^*
55. Who solved the structure of collagen?
 (A) Venki Ramakrishnan (B) G.N. Ramachandran
 (C) Sir. C.V. Raman (D) Wim Hole
56. Peptide mass finger printing generally uses the following technique to purify the protein component
 (A) HPLC technique (B) TLC technique
 (C) 2D- gel electrophoresis (D) Hybridization
57. Proline is known as helix breaker. Cause ...
 (A) Proline is rigid in structure (B) Lack of amide hydrogen
 (C) Proline is a hydrophilic residue (D) Proline is similar to Histidine.
58. Which of the following hybrid is more stable
 (A) GATCGC (B) AATGGC
 CTAGCG TTACCG
 (C) ATAGGG (D) GACTGA
 TATCCC CTGACT
59. The goose flesh is formed due to the contraction of
 (A) diaphragm (B) errector pili
 (C) trapezius muscle (D) gluteus maximus
60. The process of changing the form in order to carry out a specialized function is called
 (A) differentiation (B) growth
 (C) cell division (D) cell elongation
61. 'Dead', non-functional copies of genes present elsewhere in the genome, but no longer of any use, are called as
 (A) Pseudogenes (B) Selfish genes
 (C) Jumping genes (D) Holandric genes
62. Human genome contains approximately
 (A) one lakh genes (B) sixty thousand genes
 (C) five thousand genes (D) twenty-five thousand genes

63. Which is the most common post-translation modification seen in secreted protein?
 (A) Phosphorylation (B) Signal peptide
 (C) Glycosylation (D) Acetylation
64. The primary action of steroid hormones is at the level of
 (A) replication (B) transcription
 (C) translation (D) post transcriptional modification
65. The first researcher to sequence a genome, in 1977, was
 (A) Todd Golub (B) Frederick Sanger
 (C) Craig Venter (D) Stephen Fodor
66. Genes for typical single-character Mendelian traits are called
 (A) segmental duplications (B) multigene families
 (C) tandem clusters (D) single-copy genes
67. The median of the following data
 5, 8, 11, 8, 10, 16, 13, 8, 10, 7
 (A) 10 (B) 9 (C) 8 (D) 7
68. If three quartiles of a variable x are 5, 12, 17 then the value of Quartile Deviation is
 (A) 5 (B) 6 (C) 11.3 (D) 12
69. In Maxam and Gilberts DNA sequencing method, cleavage of purine takes place by the use of
 (A) phosphoric acid (B) dimethyl oxalate
 (C) dimethyl sulphate (D) dimethyl phosphate
70. You have two closely related proteins. Which BLOSUM or PAM matrix would you choose to compare them?
 (A) BLOSUM 80 or PAM1 (B) BLOSUM60 or PAM120
 (C) BLOSUM60 or PAM1 (D) BLOSUM45 or PAM250
71. ClustalW is based on
 (A) Iterative method (B) Hidden Markov model
 (C) Progressive method (D) Dot matrix method
72. TAIR is a database of
 (A) Genetic and molecular biology data for *Arabidopsis thaliana*
 (B) Genetic and molecular biology data for Alphaproteobacteria
 (C) *Drosophila* genome
 (D) Protein sequences

73. GeneMark is a gene prediction software that is based on
 (A) Interpolated Markov model (B) Fifth order Markov model
 (C) Sixth order Markov model (D) Fourth order Markov model
74. Rosetta is a web server that
 (A) predicts protein three-dimensional conformations using the extrinsic approach
 (B) predicts protein three-dimensional conformations using the *ab initio* method
 (C) predicts protein coding genes using the *ab initio* method
 (D) predicts promoter regions using the *ab initio* method
75. Twilight zone of protein sequence alignment has
 (A) 20-30 % sequence identity (B) above 60% sequence identity
 (C) less than 20% sequence identity (D) above 80% sequence identity
76. In how many ways can a committee of 5 people can be chosen out of 9 people?
 (A) 124 (B) 126 (C) 128 (D) 162
77. Arithmetic mean of a group of 100 items is 50 and another group of 150 items is 100. What will be the mean of all the items?
 (A) 78 (B) 80 (C) 85 (D) 80.5
78. In how many ways can the letters of the word 'bioinformatics' be arranged?
 (A) $14! / (3! \times 2!)$ (B) $14! / (14-2)!$
 (C) $14! / 3!$ (D) $14! / (14-1)!$
79. In a moderately skewed distribution, the mean and the mode are 30 and 27, respectively. What is the median of the distribution?
 (A) 28 (B) 29 (C) 31 (D) 32
80. What reagent is used in the Edman degradation of a peptide?
 (A) Mercaptoethanol (B) Phenylisothiocyanate
 (C) Trifluoroacetic acid (D) Trichloroacetic acid
81. How many domains are there in an immunoglobulin heavy chain constant region?
 (A) 2 (B) 3 (C) 6 (D) 5
82. In eukaryotes, transcription of mRNA is 1)catalyzed by what type of enzyme 2) initiated by binding of transcription factors to which important promoter sequence?
 (A) RNA polymerase IV ; TATA box
 (B) RNA polymerase I ; Goldberg-Hogness box
 (C) RNA polymerase II ; TATA box
 (D) RNA polymerase III ; Goldberg-Hogness box

83. When used in a search query the words AND, OR and NOT are capitalized because they are:
- (A) common words (B) short and easily missed
(C) Boolean operators. (D) stop words
84. Suppose the Blast search returned 100 hits. Of these, 17 were false positives and we knew that there were 165 sequences in the database which should have returned a hit with our sequence. What is the value of sensitivity of Blast in this instance?
- (A) 0.16 (B) 0.50 (C) 0.82 (D) 83
85. An independent process that produces random changes in the frequency of traits in a population is:
- (A) Genetic drift (B) Genetic code
(C) Genetic usage (D) Genetic recombination
86. When a planet moves around the sun,
- (A) the angular momentum remains conserved
(B) the angular speed remains constant
(C) the linear velocity remains constant
(D) the linear momentum remains constant
87. Distance between two parallel planes, $2x + y + 2z = 8$ and $4x + 2y + 4z + 5 = 0$, is
- (A) $3/2$ (B) $5/2$ (C) $7/2$ (D) $9/2$
88. A child is born with an extra chromosome in each of its cells. This condition is usually the result of
- (A) Non-disjunction (B) Crossing over
(C) Segregation (D) Hybridization
89. A person standing on the bank of a river observes that the angle of elevation of the top of a tree on the opposite bank of the river is θ and when he retires 40 meter away from the tree the angle of elevation becomes 2θ . The breadth of the river is
- (A) 20 m (B) 30 m (C) 40 m (D) 60m
90. A solid iron sphere A rolls down an inclined plane, while an identical hollow sphere B slides down the plane in a frictionless manner. At the bottom of the inclined plane, the total kinetic energy of sphere A is
- (A) less than that of B
(B) equal to that of B
(C) more than that of B
(D) sometimes more and sometimes less

91. When did Watson and Crick publish the helical structure of DNA?
 (A) In 1953 (B) In 1954
 (C) In 1957 (D) In 1952
92. What is the approximate size (in Mb) of the *Caenorhabditis elegans* genome?
 (A) 100 Mb (B) 235 Mb
 (C) 540 Mb (D) 1000 Mb
93. The time – independent Schrodinger equation is given by
 (A) $\Psi = E\Psi$ (B) $H\Psi = E\Psi$
 (C) $E = H\Psi$ (D) $H = E\Psi$
94. All of the following are examples of input devices EXCEPT a:
 (A) Scanner (B) Mouse
 (C) Keyboard (D) Printer
95. Which one of the following functions is used to carry out the both reading and writing the files?
 (A) `open(FH,"<filename");` (B) `open(FH,">filename");`
 (C) `open(FH,">>filename");` (D) `open(FH,"+>filename");`
96. Which one of the following is not a lymphocyte?
 (A) B-cell (B) T-cell (C) NK-cell (D) Mast-cell
97. Possible combination of gametes which can be formed by genotype AaBbCcDdEeFfGg are
 (A) 16 (B) 32 (C) 64 (D) 128
98. The dendrogram resulting from the application of numerical taxonomical methods shows
 (A) Evolutionary relationship (B) Phylogenetic relationship
 (C) Overall similarity (D) Genetic relationship
99. Which one of the following is the full form of SARF:
 (A) Structural ARrangement of backbone Fragments
 (B) Similar ARrangement of backbone Fragments
 (C) Spartial ARrangement of backbone Fragments
 (D) Sequence ARrangement of backbone Fragments
100. Which of the following is not a programming language?
 (A) UNIX (B) PASCAL (C) FORTRAN (D) BASIC