

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.

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. In Homology modelling, the region of the protein sequence that needs to be built is termed as

(A) Conserved region	(B) Loops
(C) Template	(D) Rotamer

2. "—————" is a sequence of a polypeptide chain that can independently fold into a stable three dimensional structure.

(A) Sheet	(B) Domain	(C) Motif	(D) Chain
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3. What is the difference between RefSeq and GenBank?

(A) RefSeq includes publicly available DNA sequences	(B) GenBank includes non-redundant curated data
(C) GenBank sequences are derived from RefSeq	(D) RefSeq sequences are derived from GenBank

4. The two main features of any phylogenetic tree are the

(A) Clades and nodes	(B) Toplogy and branch length
(C) Clades and root	(D) Alignment and bootstrap

5. Which of the following class of proteins are difficult to model?

(A) G-coupled proteins	(B) CDKs
(C) Kinases	(D) Lyases

6. 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
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7. Are hydrogens present in the 3D structure file of a protein(*.pdb) downloaded from Protein Data Bank?

(A) Yes	(B) No
(C) Sometimes present	(D) None of the above

8. *.pdb, *.mol, *.sdf, *.mae are "—————" type of file formats

(A) String	(B) 2D	(C) 3D	(D) Fingerprint
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9. 'Ligplot' represents

(A) Receptor-Ligand interactions	(B) Receptor surfaces
(C) Analyzes receptor cavity	(D) Detects binding site

10. Out of the 3D-structure file (*.pdb) and sequence file (FASTA), which has a bigger file size?
 (A) 3D-structure file (*.pdb) (B) Sequence file (FASTA)
 (C) Both are of same size (D) File size is negligible
11. Force fields used in most docking softwares are based on
 (A) Quantum Mechanics (B) Molecular Mechanics
 (C) Classical Mechanics (D) None of the above
12. Quantum mechanical methods refer to
 (A) Ab initio (B) Semi empirical
 (C) Empirical (D) Both (A) and (B)
13. "—————" is a computationally intensive method.
 (A) Quantum Mechanics (B) Molecular Mechanics
 (C) Both (A) and (B) (D) None of the above
14. The lowest energy point on a potential energy surface is termed as
 (A) Saddle point (B) Local minima
 (C) Global minima (D) Optimum minima
15. Which of the following is not an energy minimization method
 (A) Monte Carlo (B) Conjugate Gradient
 (C) Newton-Raphson (D) Steven-Jhonson
16. The filtering program "SEG" is available for
 (A) BLAST P (B) BLAST N
 (C) Genome BLAST (D) BLAST X
17. The identification of drugs through genomic study
 (A) Genomics (B) Cheminformatics
 (C) Pharmagenomics (D) Phrmacogenetics
18. Which of the following is not a functional category in Gene Ontology (GO) terms?
 (A) Physiological function (B) Biological function
 (C) Cellular function (D) Molecular function
19. Which of the following of the Lipinski rule of five is not true?
 (A) A molecular mass should be less than 500 Dalton
 (B) High lipophilicity
 (C) More than 5 hydrogen bond donor
 (D) Less than 10 hydrogen bond acceptor

20. In following Perl Script, what gets printed?

```
my $a=(0,1,2)
print "$a\n";
```

(A) 0 (B) 1 (C) 2 (D) 3
21. In C Programing, which of the following is a properly defined struct?
(A) struct {int a;} (B) struct a_struct {int a;}
(C) struct a_struct int a; (D) struct a_struct {int a};
22. Which of the following is NOT a characteristic of all Object Oriented Programming Languages?
(A) Inheritance (B) Garbage collection
(C) Abstraction (D) Data hiding
23. The expansion of LPFC is
(A) Library of Protein Family Cores (B) Library of Protein Function Cores
(C) Library of Protein Fold Cores (D) None of these
24. Which one of the following is curated protein sequence database?
(A) SwissProt (B) Prodom (C) SMART (D) Sakura
25. Who developed BLOSUM matrices and in which year?
(A) Needleman and Wunsch, 1976 (B) Smith-Waterman, 1978
(C) Dayhoff et al., 1978 (D) Henikoff and Henikoff, 1992
26. What does BCC means in E-Mail?
(A) Black Carbon Copy (B) Blind Carbon Copy
(C) Business Computer Center (D) Business Computer Card
27. Which one of the following is defined as the period of time that a unique user interacts with a Web application?
(A) Application (B) Session (C) Cookie (D) Query String
28. Which of these is the first web based e-mail service?
(A) Gmail (B) Yahoo mail (C) Hotmail (D) Rediff mail
29. Which one of the following is not an example of real security and privacy risks?
(A) Hackers (B) Spam (C) Viruses (D) Identity theft

30. A process known as _____ is used by large retailers to study trends
- (A) Data mining (B) Data selection
(C) POS (D) Data conversion
31. Which of the following is NOT one of the four data processing functions of a computer?
- (A) Gathering data (B) Processing data into information
(C) Analyzing the data or information (D) Storing the data or information
32. Technology no longer protected by copyright, available to everyone, is considered to be
- (A) Proprietary (B) Open
(C) Experimental (D) In the public domain
33. Smaller and less expensive PC-based servers are replacing _____ in many businesses
- (A) Super computers (B) Clients
(C) Laptops (D) Mainframes
34. _____ are specially designed computer chips that reside inside other devices, such as your car or your electronic thermostat
- (A) Embedded computers (B) Robotic computers
(C) Servers (D) Mainframes
35. Distributed data entry means that data can be
- (A) Entered at different locations where it originates
(B) Sent to different locations from a central place
(C) Accessed from different places know as distribution points
(D) Distributed through a network
36. In a home computer user wants access to national database networks he/she at lest requires
- (A) A microcomputer, a modem, a telephone line
(B) A microcomputer, a tele-printer, a telephone line
(C) A microcomputer, communications soft-ware, a telephone line
(D) A microcomputer, a modem, communications software, a telephone line
37. Two forces represented by $(2i-7j+7k)$ and $(-2i+7j-16k)$ 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

38. 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
39. 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
40. 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
41. Which of the following is a scalar?
- (A) kinetic energy (B) electric field intensity
(C) acceleration (D) linear momentum.
42. With decrease in temperature, the frictional force acting between two surfaces
- (A) decreases (B) increases
(C) remains the same (D) may increase or decrease
43. The temperature scale that will read only positive values is :
- (A) Centigrade scale (B) Fahrenheit scale
(C) Kelvin scale (D) Reaumer scale
44. $\nabla \cdot (\nabla \times A) =$ (where ∇ is the standard del operator and A is a vector)
- (A) 0 (B) $(\nabla \cdot A)$ (C) $\nabla \cdot A$ (D) ∇A
45. 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
46. According to Kepler's third law, the period of a planet is proportional to
- (A) $R^{3/2}$ (B) $R^{2/3}$ (C) R^2 (D) R^3
47. Mention the type of following reaction
 $\text{CH}_3 - \text{CH}_2\text{OH} + \text{HCl} \rightarrow \text{CH}_3 - \text{CH}_2\text{Cl} + \text{H}_2\text{O}$
- (A) Addition (B) Substitution
(C) Hydrogenation (D) Elemination

48. Natural amino acids found in following conformation
(A) L and D (B) D and R (C) L (D) D and S
49. Chiral carbon is the one
(A) Having all four different attached group
(B) Radio labeled carbon
(C) Carbon used in C13 NMR spectroscopy
(D) Carbon present other than organic compounds
50. L and D notation for chemical samples was denoted based on
(A) Ramachandran plot
(B) Linus Pauling and Robert Corey's prediction
(C) Emil Fischer's work
(D) IUPAC rule
51. Zwitter ions are the one
(A) Having Neutral and free radicals
(B) Having Negative ions and free radicals
(C) Having positive and negative ions
(D) Having positive ion and free radicals
52. An ampholyte having $pI = 5$ is more negatively charged at the following pH
(A) 4 (B) 7 (C) 9 (D) 3
53. Benzene is most stable due to
(A) The resonance of Pi electrons
(B) S-orbitals have created a hybridized system that has become delocalized
(C) The sigma bonding system hybridized to create a flat shape which gives benzene its symmetry
(D) Its chemical nature
54. The molecular formula for benzene is
(A) C_6H_{14} (B) C_6H_{12} (C) C_6H_6 (D) C_6H_{10}
55. Benzene can have following conformation in acidic solution
(A) Boat form (B) Chair form
(C) Planar form (D) Boat and chair form

65. A class contains 10 male and 20 female students, of which half the male and half the female students have brown-eyes. What is the probability p that a student chosen at random is a male or has brown-eyes
 (A) $1/6$ (B) $2/3$ (C) $1/3$ (D) $5/6$
66. A fair coin is tossed three times. What is the probability of appearing exactly 2 heads?
 (A) $1/4$ (B) $1/8$ (C) $3/8$ (D) $3/4$
67. The period of revolution of sun at pole is
 (A) 1 day (B) 25 days (C) 34 days (D) 7 days
68. The rate of the first order reaction depends on the
 (A) Concentration of the reactant (B) Concentration of the product
 (C) Time (D) Temperature
69. A genetic change that occurs between 1% to 99% of individuals in a population:
 (A) Polymorphism (B) Mutation
 (C) Substitution (D) Recombination
70. A genetic change that is completely fixed in a population:
 (A) Polymorphism (B) Mutation
 (C) Substitution (D) Recombination
71. Which of the following is NOT a measure of variability:
 (A) Mean (B) Variance (C) Standard deviation (D) Range
72. A distribution which is skewed to the left is known as :
 (A) Symmetrical (B) Negatively skewed
 (C) Positively skewed (D) Symmetrically skewed
73. Which of the following statement is a null hypothesis :
 (A) There is a positive correlation in height and weight
 (B) There is no correlation between height and weight
 (C) There is a negative correlation between income and illiteracy
 (D) There is a positive correlation between income and literacy
74. A distribution which is skewed to the right is known as :
 (A) Symmetrical (B) Negatively skewed
 (C) Positively skewed (D) Symmetrically skewed

75. Paralogous genes have:
- (A) Same function in different organisms
 - (B) Same function in one organism
 - (C) Different functions in different organisms
 - (D) Different functions in one organism
76. PSI-BLAST is required for detection of
- (A) Close homologs
 - (B) Remote homologs
 - (C) Intermediate homologs
 - (D) Pseudo homologs
77. Which one of the following is not a program for multiple sequence alignment:
- (A) Clustal X
 - (B) T-coffee
 - (C) CAPS
 - (D) MUSCLE
78. Which one of the following database is not related to ENTREZ:
- (A) GEO
 - (B) Ensembl
 - (C) OMIM
 - (D) GenBank
79. The DNA sequences commonly used for phylogenetic analysis in bacteria are
- (A) 18S rDNA
 - (B) 16S rDNA
 - (C) 45S rDNA
 - (D) 60S rDNA
80. Which of the following is not part of the lac operon of *E. coli*?
- (A) genes for inducible enzymes of lactose metabolism
 - (B) genes for the repressor, a regulatory protein
 - (C) gene for RNA polymerase
 - (D) a promoter, the RNA polymerase binding site.
81. Bacteria utilize glucose first, even if other sugars are present, through a mechanism called:
- (A) operon repression
 - (B) enzyme repression
 - (C) catabolite repression
 - (D) gene regulation
82. Which of the following growth media would you expect to result in synthesis of high levels of mRNA for the enzymes of the *E. coli* lac operon?
- (A) high glucose, high lactose
 - (B) no glucose, no lactose
 - (C) high glucose, low lactose
 - (D) no glucose, high lactose
83. An *E. coli* cell is grown in the presence of high amounts of glucose. Which of the following is true?
- (A) the cell will utilize lactose as a carbon source exclusively
 - (B) the level of cyclic AMP in the cell will be low
 - (C) the level of cyclic AMP in the cell will be high
 - (D) the cell will be forced to carry out fermentation

84. The primary RNA transcript of the chicken ovalbumin gene is 7700 nucleotides long, but the mature mRNA that is translated on the ribosome is 1872 nucleotides long. This size difference occurs primarily as a result of:
- (A) capping (B) cleavage of polycistronic mRNA
(C) removal of poly A tails (D) splicing
85. Blood stains are found at the site of a murder. If DNA profiling technique is to be used for identifying the criminal, which of the following is ideal for use?
- (A) erythrocytes (B) leucocytes (C) platelets (D) serum
86. By the statement "survival of the fittest" Darwin meant that _____
- (A) the strongest of all species survives
(B) the most intelligent of the species survives
(C) the cleverest of the species survives
(D) the most adaptable of the species to changes survives
87. Which one of the following is not a second messenger in hormone action?
- (A) Calcium (B) Sodium (C) cAMP (D) cGMP
88. When DNA replication starts
- (A) the phosphodiester bonds between the nucleotides of two strands break
(B) the hydrogen bonds between the nucleotides of two strands break
(C) the bonds between the nitrogen base and deoxyribose sugar break
(D) the leading strand produces okazaki fragments.
89. The number of ATP produced when a molecule of glucose undergoes fermentation is
- (A) 4 (B) 36 (C) 2 (D) 38
90. With reference to enzymes, turnover number means
- (A) the number of substrate molecules that a molecule of an enzyme converts into products per second
(B) the number of substrate molecules that a molecule of an enzyme converts into products per hour
(C) the number of substrate molecules that a molecule of an enzyme converts into products per minute
(D) the number of substrate molecules that a molecule of an enzyme converts into products per day

91. Michaelis-Menten equation describes the rate of the enzymatic reaction as a function of
 (A) Co-enzyme concentration (B) Product concentration
 (C) Temperature (D) Substrate concentration
92. Which of the following is not a stop codon?
 (A) UAA (B) UAG (C) UGA (D) AUG
93. In Homology modelling, the region of the protein sequence that needs to be built is
 (A) Conserved region (B) Loops
 (C) Template (D) Rotamer
94. A QSAR model building depends on
 (A) Alignment of dataset molecules
 (B) Activity range of the dataset molecules
 (C) Number of the molecules present in the dataset
 (D) All of the above
95. Concentration of a drug that is required for 50% inhibition in vitro is called
 (A) IC_{50} (B) EC_{50} (C) ED_{50} (D) $\frac{1}{2} IC_{50}$
96. The Boolean operators 'AND', 'OR' and 'NOT' are called as
 (A) Conditional operators (B) Non-conditional operators
 (C) Numeric operators (D) Non-numeric operators
97. Which of the following is not a DNA sequence database?
 (A) GenBank (B) EMBL (C) DDBJ (D) PIR
98. Mean and Variance are equal for a distribution which is
 (A) Asymmetric (B) Normal (C) Poisson (D) Skew
99. PHYLIP database is used for
 (A) Sequence analysis and alignment (B) Phylogenetic analysis
 (C) Motif detection (D) Active site analysis
100. 'DOTS' treatment is used for
 (A) Tuberculosis (B) AIDS (C) Malaria (D) Dengue