SUBJECT CODE: BI/PC/ME43

M. Sc. DEGREE EXAMINATION, APRIL 2009
BIOINFORMATICS
FOURTH SEMESTER

COURSE   : CORE
PAPER   : MOLECULAR EVOLUTION
TIME   : 3 HOURS   MAX. MARKS: 100

SECTION – A

ANSWER ALL QUESTIONS   (1 X 8 = 8)

I   CHOOSE THE CORRECT ANSWER:

1.   Male-driven evolution is the effect of the mutation rate on the
      a) rate of substitution   b) rate of transposition   c) gene expression
      d) gene deletion
2.   The total number of substitutions at both informative and uninformative sites in a
      particular tree is called the
      a) tree junctions   b) tree length   c) discordant tree
      d) None of the above
3.   The rate of nucleotide substitution, r, is defined as the number of substitutions
      a) per site per day   b) per site per week   c) per site per year
4.   The sole culprit for the C-value paradox is the
      a) Genic DNA fraction   b) intergenic DNA fraction
      c) nongenic DNA fraction
5.   A method that can be used to generate topologically similar trees from an initial
      one is
      a) Tree cutting   b) sub tree pruning   c) hybridization
      d) none of the above
6.   _____ _____ _____ by fusion seems to be a recurrent evolutionary
      occurrence.
      a) Chromosomal number reduction.
      b) Chromosomal number increase
      c) Chromosomal number neutralization.
      d) None of the above
7.   A member of a gene family that is located alone at a different genome location
      than the other members of the family is called an
      a) Nested gene   b) Selfish gene   c) Orphon   d) None of the above
8.   Which of the following statements about gene silencing is true?
      a) The silencing of a gene due to deleterious mutations produces an unprocessed
         gene.
      b) The silencing of a gene is due to deleterious mutations produces a processed
         gene.
      c) The silencing of a gene is due to deleterious mutations produces an
         unprocessed pseudogene.
      d) The silencing of a gene is due to deleterious mutations produces a processed
         pseudogene.

..2

II   FILL IN THE BLANKS   (5 x 1 = 5)

9.   If two sequences of length N differ from each other at n sites, then the proportion of differences, n/N is called as _____ _____.

10. A phylogenetic tree is a graph composed of _____ and _____.

11. In scaled trees, each _____ _____ is proportional to the number iof changes.

12. Structural domains are also known as _____.

13. In haploid organisms, the genome size refers to the total amount of _____ in the genome.

III   DEFINE IN ONE OR TWO SENTENCES: (2 x 1 = 2)

14. Newick Format.

15. Selfish DNA

IV   STATE WHETHER TRUE OR FALSE   (1 x 5 = 5)

16. In the classification of sites, a site is defined as invariant if all the OUT's under study possess the same character state at this site.

17. Gene duplication may or may not result in an increase in the no.of copies of a DNA.

18. Two genes are said to be orthologous if they are derived from a duplication event and paralogous if they are derived from a speciation event.

19. The ratio u/v is also called the GC mutational pressure.

20. The Neutral theory of molecular evolution states that the rate of substitution is $K=v_0$.

SECTION – B

ANSWER ANY FOUR QUESTIONS.   (4 X 10 = 40)

21. What is meant by Minimal Genome? Illustrate with examples. Explain C – Value Paradoxes.

22. What are the different types of gene duplication? Explain domain duplication and gene elongation.

23. What is meant by Genetic Polymorphism? Add a note on Hardy Weinberg equilibrium.

24. Explain molecular phylogenetic archaeology using suitable examples.

25. Write notes on: a) The Globin family

                b) Rooted and unrooted trees

                c) Gene trees and species trees

26. Discuss how non genic DNA is maintained. Add a note on the repetitive structure of the Eukaryotic Genome.

27. Does the rate of nucleotide substitution vary between coding and non-coding regions? Discuss.

SECTION – C

ANSWER ANY TWO QUESTIONS.   **(2 x 20 = 40)**

28. a) Discuss how nucleotide substitution takes place in a DNA sequence. Illustrate your answer using two models. Explain briefly the number of substitutions between two non-coding sequences.

                              (OR)

      b) Write short notes on: i) Molecular and Local clocks

         ii) Dating Gene Duplications   iii) GC content in Bacteria

29. a) Describe the different mechanisms for global increases in genome size. Discuss how non-genic DNA is maintained.

                              (OR)

      b) Describe any TWO methods of Phylogenetic tree reconstruction. Add a note on the problems

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