Algorithmic Game Theory
Assignment 0

Palash Dey
Indian Institute of Technology, Kharagpur

1. Suppose the probability of two events A and B in a probability space is 0.3 and 0.4 respectively. What is the maximum probability possible for the event $A \cap B$?

   (a) 0.12
   (b) 0.3
   (c) 0.4
   (d) 0.75

   The correct answer is (b).

2. Suppose the probability of two independent events A and B in a probability space is 0.3 and 0.4 respectively. What is the probability possible for the event $A \cap B$?

   (a) 0.12
   (b) 0.3
   (c) 0.4
   (d) 0.75

   The correct answer is (a).

3. Suppose in a factory there are two machines, namely A and B, which produce the same good. The machine A produces 10% of the goods whereas the machine B produces the remaining 90% of the goods. Among the goods produced by machine A, 20% are found to be defective whereas, among the goods produced by machine B, only 5% are defective. For a defective good, what is the probability that it is produced by machine A?

   (a) $\frac{4}{15}$
   (b) $\frac{3}{11}$
   (c) $\frac{4}{13}$
   (d) $\frac{2}{11}$

   The correct answer is (c).

4. Which of the following is incorrect?

   (a) $n \ln n + 5n - 3 = \mathcal{O}(n^2)$
   (b) $n \ln n + 5n - 3 = \mathcal{O}(n^{1.5})$
   (c) $n \ln n + 5n - 3 = \mathcal{O}(n^{1.001})$
   (d) $n \ln n + 5n - 3 = \mathcal{O}(n)$

   The correct answer is (d).

5. Which one of the following sorting algorithms have the minimum worst case asymptotic running time?

   (a) Insertion sort

(b) Quick sort

(c) Heap sort

(d) Selection sort

The correct answer is (c).

6. Which algorithm design paradigm the Dijkstra's algorithm for the single source shortest path problems follows?

   (a) greedy algorithm

   (b) dynamic programming

   (c) branch and bound

   (d) back tracking

   The correct answer is (a).

7. In how many ways, 30 identical balls can be distributed among 5 children?

   (a) $\binom{30}{5}$

   (b) ${}^{30}P_5$

   (c) 5^{30}

   (d) $\binom{34}{4}$

   The correct answer is (d).

8. In how many ways, 30 different balls can be distributed among 5 children?

   (a) $\binom{30}{5}$

   (b) ${}^{30}P_5$

   (c) 5^{30}

   (d) $\binom{34}{4}$

   The correct answer is (c).

9. On a set of 10 elements, how many binary relations can be defined?

   (a) 10!

   (b) 2^{10}

   (c) 2^{100}

   (d) 100!

   The correct answer is (c).

10. Solve the following recurrence relation.

$$T(n) = \begin{cases} \frac{n}{2} + 7n & \text{if } n \geqslant 2 \\ 1 & \text{otherwise} \end{cases}$$

    (a) $\Theta(n)$

    (b) $\Theta(n^2)$

    (c) $\Theta(n \log n)$

    (d) $\Theta(\log n)$

    The correct answer is (a).