

**Student Matric Number:**

**National University of Singapore  
Department of Electrical and Computer Engineering  
EE2003 Engineering Mathematics  
Continual Assessment: Who wants to be a Probabilionaire?**

**Time Allowed: 55 minutes**

**Max Marks: 105**

**Answer all questions. Mark your answers on the CA sheet and submit at the end.**

1. Arrange the following events in the decreasing order of probability  
(a) sun rising in the east (b) H shows up in a fair coin toss  
(c) 1 or 3 shows up in a throw of dice (d) H shows up twice in 5 tosses of a fair coin

**Answer: (a), (b), (c), (d)**

2. Probability is a measure of  
(a) randomness (b) uncertainty (c) chance (d) all of these

**Answer: (d)**

3. A non-deterministic experiment is one  
(a) that cannot be conducted (b) that has an infinitely large number of outcomes  
(c) exact outcome is not known till experiment is conducted  
(d) cannot determine all possible outcomes

**Answer: (c)**

4. Two events A and B are statistically independent if  
(a) they cannot occur together (b) they always occur together  
(c)  $P(A) > P(B)$  (d)  $P(AB) = P(A)P(B)$ .

**Answer: (d)**

5. Two events A and B are mutually exclusive if  
(a) they cannot occur together (b)  $P(AB) = P(A)P(B)$   
(c) they are not a part of same sample space (d) at least one of two is a null event

**Answer: (a)**

6. Two balls are drawn from a bag containing 3 red and 5 blue balls without replacement. If the second ball is red, what is the probability that the first is also red  
(a)  $2/7$  (b)  $3/8$  (c)  $2/8$  (d) none of these

**Answer: (a)**

7. A dice is thrown 20 times. The probability that 3 shows up 10 times and 5 shows up 5 times is

(a)  $[20!/(10!5!5!)](1/6)^{10}(2/3)^{10}$  (b)  $[20!/(10!5!5!)](1/6)^{15}(2/3)^5$   
(c)  $[20!/(10!10!)](1/6)^{15}(2/3)^5$  (d)  $[10!/(5!5!)](1/6)^{15}(5/6)^5$

**Answer: (b)**

8. A coin,  $\text{prob}(H) = p$ , is tossed N times and later M times. Define X = total number of times H shows up.

- (a) X is binomial pdf with parameters N+M and p  
(b) X is exponential with parameters N and p

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- (c) X is Gaussian with parameters  $(N+M)p$  and  $Np(1-p)$   
(d) X is Poisson with parameter  $(N+M)p$ .

**Answer: (a)**

9. In the above problem, 'X is Gaussian' requires that

- (a)  $(N+M)$  be large and  $p$  tend to 0  
(b)  $p$  tend to 0  
(c)  $(N+M)$  be large  
(d) none of these

**Answer: (c)**

10. In a class of 300 students, the probability that two students have same birthday is

- (a) close to 1 (b) close to 0.75 (c) close to 0.5 (d) close to 0.25

**Answer: (a)**

11. Given a random variable X uniformly distributed over  $[-2, 2]$ , define  $Y = |X|$ . Y is

- (a) Gaussian (b) uniformly distributed over  $[0, 2]$   
(c) uniformly distributed over  $[0, 4]$  (d) binomial

**Answer: (b)**

12. Given the moments  $E(X^k)$ ,  $k = 1, 2, \dots$ , the pdf of X can be determined

- (a) True (b) False

**Answer: (a)**

13. Given SI random variables  $X_1, X_2, \dots, X_n$ ,  $n$  large, the pdf of  $X = (1/n)(X_1 + X_2 + \dots + X_n)$  is

- (a) Gaussian with parameters  $(m, \sigma^2)$ ,  $m = \text{sum of means}$ ,  $\sigma^2 = \text{sum of } \sigma^2$   
(b) Gaussian with parameters  $(m, \sigma^2)$ ,  $m = \text{sum of means}$ ,  $\sigma = \text{sum of } \sigma$   
(c) Gaussian with parameters  $(m, \sigma^2)$ ,  $m = (\text{sum of means})/n$ ,  $\sigma^2 = \text{sum of } \sigma^2$   
(d) Gaussian with parameters  $(m, \sigma^2)$ ,  $m = (\text{sum of means})/n$ ,  $\sigma^2 = (\text{sum of } \sigma^2)/n^2$

**Answer: (d)**

14. Given two SI random variables X and Y, each having normal pdf with 0 mean and standard deviation 25, probability of the event  $(X > 0 \text{ and } Y > 0)$  is given by

- (a)  $1/2$  (b)  $1/4$  (c)  $1/16$  (d) cannot be determined

**Answer: (b)**

15. For Poisson arrivals ( $X(t) = \text{no of arrivals in } (0, t)$ , is a Poisson random variable), let  $T = \text{inter-arrival time} = \text{time between two successive arrivals}$ . The pdf of T is

- (a) Gaussian (b) exponential (c) uniform (d) Cauchy

**Answer: (b)**

16. Done already.