Assignment 5
The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

1) Any function of a random variable is a random variable.
   - True
   - False
   No, the answer is incorrect.
   Score: 0
   Accepted Answers: True

2) Jumps in the graph of the CDF characterize the discrete random variables.
   - True
   - False
   No, the answer is incorrect.
   Score: 0
   Accepted Answers: True

3) For any point $x$ in the domain of a random variable $X$, if $P[X = x] = 0$, then $F_X$ is continuous at $x$.
   - True
   - False
   No, the answer is incorrect.
   Score: 0
   Accepted Answers: True

4) The function,
   \[ F(x) = \begin{cases} 
   1 - a \exp \left(-\frac{x}{a}\right) & x > 0 \\
   0 & x < 0 
   \end{cases} \]
   is a valid CDF of a continuous non-negative random variable when $a = \_\_\_$. 
   - $\infty$
   - 1
   - 0
   - $\frac{1}{2}$
   No, the answer is incorrect.
   Score: 0
   Accepted Answers: 1

5) In the experiment of tossing a fair coin thrice, if $X$ is the random variable denoting the number of heads obtained, then $P[X = 2]$ and $P[X < 2]$ are respectively,
   - $\frac{3}{8}$, $\frac{1}{2}$
   - $\frac{1}{8}$, $\frac{1}{2}$
   - $\frac{1}{8}$, $\frac{3}{8}$
   - $\frac{1}{2}$, $\frac{3}{8}$
   - $\frac{3}{8}$, $\frac{1}{8}$
   No, the answer is incorrect.
   Score: 0
   Accepted Answers: 1
An information source generates symbols at random from a four letter alphabet \{a, b, c, d\} with probabilities \(P[a] = \frac{1}{4}, P[b] = \frac{1}{4}, P[c] = P[d] = \frac{1}{8}\). A coding scheme encodes these symbols into binary codes as follows.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>0</td>
</tr>
<tr>
<td>b</td>
<td>10</td>
</tr>
<tr>
<td>c</td>
<td>110</td>
</tr>
<tr>
<td>d</td>
<td>111</td>
</tr>
</tbody>
</table>

Let \(X\) denote the length of the code, i.e., the number of bits. Assuming the generations of symbols are independent, the probability \(P[X = 3]\) is ________.

\[
\begin{align*}
\text{No, the answer is incorrect.} \\
\text{Score: 0} \\
\text{Accepted Answers:} \\
\frac{1}{4} \\
\end{align*}
\]

7) Consider the experiment of throwing a dart onto a circular plate with unit radius. Let \(X\) be the random variable representing the distance of the point where the dart lands from the origin of the plate. Assuming that the dart always lands on the plate and that the dart is equally likely to land anywhere on the plate, the probability \(P(0.25 < X < 0.5)\) is ________.

\[
\begin{align*}
\text{No, the answer is incorrect.} \\
\text{Score: 0} \\
\text{Accepted Answers:} \\
0.25 \\
0.0625 \\
0.1875 \\
0.5 \\
\end{align*}
\]

8) Consider the function,

\[
F(x) = \begin{cases} 
0, & x < 0 \\
 x + \frac{1}{2}, & 0 \leq x < \frac{1}{2} \\
1, & \text{otherwise}
\end{cases}
\]

If \(X\) is a random variable whose CDF is given by \(F(x)\), then the value of \(P\left[0 \leq X \leq \frac{1}{4}\right]\) is ________.

\[
\begin{align*}
\text{No, the answer is incorrect.} \\
\text{Score: 0} \\
\text{Accepted Answers:} \\
\frac{1}{4} \\
\frac{1}{2} \\
\frac{1}{3} \\
\frac{1}{2} \\
\end{align*}
\]
9) Which of the following random variables is geometric?

- Number of phone calls received in a one-hour period.
- Number of times a die has to be rolled to get two 5's.
- Number of digits that has to be read from a randomly selected starting point in a table of random digits until a 7 is obtained.
- Number of 7's in a row of 40 random digits.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Number of digits that has to be read from a randomly selected starting point in a table of random digits until a 7 is obtained.

10) $X$ is a standard Gaussian random variable. Where does $f_X$, the density function of $X$, attain its maximum and what is the maximum value?

- $\max = 1$ at $x = \infty$
- $\max = \frac{1}{\sqrt{2\pi}}$ at $x = \infty$
- $\max = 1$ at $x = 0$
- $\max = \frac{1}{\sqrt{2\pi}}$ at $x = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\max = \frac{1}{\sqrt{2\pi}}$ at $x = 0$

11) Let $F$ be a distribution function of a random variable $X$. $F(x)$ is continuous and $\frac{dF(x)}{dx} = 0$ for almost all $x$. What type of random variable is $X$?

- Discrete
- Singular
- Continuous

No, the answer is incorrect.
Score: 0
Accepted Answers:
Singular