RV Educational Institutions ®

RV College of Engineering ®

Autonomous
Institution Affiliated
to Visvesvaraya
Technological
University, Belagavi

Approved by AICTE,
New Delhi

<table>
<tr><th>Q.No</th><th>Solutions</th><th>Marks</th></tr>
<tr><td>1.</td><td>i) $\begin{bmatrix}1\\1\end{bmatrix}, \begin{bmatrix}2\\4\end{bmatrix} \in S_1$ but $\begin{bmatrix}1\\1\end{bmatrix} + \begin{bmatrix}2\\4\end{bmatrix} = \begin{bmatrix}3\\5\end{bmatrix} \notin S_1$(or any other suitable justification), Not a subspace.
ii) Justification. Subspace.
iii) Justification. Subspace.
iv) Justification. Not a subspace.
v) Justification. Not a subspace.</td><td>1+1
2+2
2+2</td></tr>
<tr><td>2.a</td><td>$t = c_1u + c_2v + c_3w$; $2 = c_1 + 2c_2 + 2c_3$, $5 = 3c_1 - 2c_2 - c_3$, $-4 = 2c_1 - 5c_2 + 3c_3$, $0 = c_1 + 4c_2 + 6c_3$
$\begin{bmatrix}1 & 2 & 2\\3 & -2 & -1\\2 & -5 & 3\\1 & 4 & 6\end{bmatrix}\begin{bmatrix}c_1\\c_2\\c_3\end{bmatrix} = \begin{bmatrix}2\\5\\-4\\0\end{bmatrix}$ this system reduces to $\begin{bmatrix}1 & 2 & 2\\0 & 1 & -6\\0 & 0 & 1\\0 & 0 & 0\end{bmatrix}\begin{bmatrix}c_1\\c_2\\c_3\end{bmatrix} = \begin{bmatrix}2\\7\\-1\\0\end{bmatrix}$
$c_3 = -1$ $c_2 = 1$ and $c_1 = 2$
$t = 2u + 1v - 1w$</td><td>1+2
1
1</td></tr>
<tr><td>2.b</td><td>Suppose $c_1(1 + x - 2x^2) + c_2(2 + 5x - x^2) + c_3(x + x^2) = 0$
$c_1 + 2c_2 = 0$, $c_1 + 5c_2 + c_3 = 0$, $-2c_1 - c_2 + c_3 = 0$
$\begin{bmatrix}1 & 2 & 0\\1 & 5 & 1\\-2 & -1 & 1\end{bmatrix}\begin{bmatrix}c_1\\c_2\\c_3\end{bmatrix} = \begin{bmatrix}0\\0\\0\end{bmatrix}$ $\det\begin{bmatrix}1 & 2 & 0\\1 & 5 & 1\\-2 & -1 & 1\end{bmatrix} = 0$
Therefore, the above homogeneous system has non-trivial solution.
Hence, the given set of polynomials is a linearly dependent set in P_2</td><td>1
2
1
1</td></tr>
<tr><td>3.a</td><td>i) $12k^2 + 9k = 1 \Rightarrow k = 0.0982$
ii) $P(X \geq 5) = 0.214$, $P(X < 3) = 0.2946$, $P(2 < X \leq 5) = 0.51993$
ii) $E[X] = 3.6789$</td><td>2
2
2</td></tr>
<tr><td>3.b</td><td>$X = \{0, 1, 2, 3\}$
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>$p(x)$</td><td>$\frac{C(5,3)}{C(7,3)} = \frac{10}{35}$</td><td>$\frac{C(5,2)C(2,1)}{C(7,3)} = \frac{20}{35}$</td><td>$\frac{C(5,1)C(2,2)}{C(7,3)} = \frac{5}{35}$</td><td>0</td></tr>
<tr><td>CDF</td><td>10/35</td><td>30/35</td><td>35/35=1</td><td>1</td></tr>
</table></td><td>1
2
1</td></tr>
<tr><td>4.a</td><td>i) $P(X < 1.2) = \int_0^1 xdx + \int_1^{1.2}(2 - x)dx = 0.68$
ii) $P(0.5 < X < 1) = \int_{0.5}^1 x\,dx = 0.375$</td><td>3
3</td></tr>
<tr><td>4.b</td><td>Probability mass function $= \frac{d(F(x))}{dx} = 8e^{-8x}$
$P(X < 12) = 1 - e^{-1.6}$</td><td>2
2</td></tr>
<tr><td>5.a</td><td>i) Marginal distribution of X and Y
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>p(x)</td><td>0.1</td><td>0.35</td><td>0.55</td></tr>
</table>
<table>
<tr><td>y</td><td>1</td><td>3</td><td>5</td></tr>
<tr><td>p(y)</td><td>0.2</td><td>0.5</td><td>0.3</td></tr>
</table>
ii) $P(X > 1, Y \geq 3) = 0.75$, $P(X < 3, Y = 3) = 0.15$.
iii) $Cov(X,Y) = E[XY] - E[X]E[Y] = 7.85 - 2.45 \times 3.2 = 0.01$.</td><td>1+1
2
2</td></tr>
<tr><td>5.b</td><td>Let $X = \{x \mid x = a + b < 5, (a,b) \in \Omega\} = \{2, 3, 4\}$, $Y = \{y \mid y = \max(a,b)\} = \{1, 2, 3, 4\}$
Joint probability distribution $p(x,y)$
$P(X = 2, Y = 1) = P((1,1)) = 1/16$
<table>
<tr><td rowspan="2">$p(x,y)$</td><td></td><td colspan="3">x</td></tr>
<tr><td></td><td>2</td><td>3</td><td>4</td></tr>
<tr><td rowspan="4">y</td><td>1</td><td>1/16</td><td>0</td><td>0</td></tr>
<tr><td>2</td><td>0</td><td>1/8</td><td>1/16</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>1/8</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>0</td></tr>
</table></td><td>1
3</td></tr>
</table>