Que 1 → Given, $B(0) = Rs\ 100$

$B(1) = Rs.\ 110$

$S(0) = Rs\ 80$, $S(1) = \begin{cases} Rs\ 100, & p = 0.8 \\ Rs\ 60, & p = 0.2 \end{cases}$

Let stocks & bonds be $3x$ & $2x$

$V(0) = 100000$

$\therefore (80 \times 3x) + (100 \times 2x) = 100000$

$x = \frac{100000}{440} = \frac{2500}{11}$

$V(1) = \begin{cases} \frac{2500}{11}(100 \times 3 + 110 \times 2) = Rs.118,181.81 \\ \frac{2500}{11}(3 \times 60 + 2 \times 110) = Rs.\ 90,909.1 \end{cases}$

$K_V = \frac{V_1 - V_0}{V_0} = \begin{cases} 0.1818 & ; p = 0.8 \\ -0.0909 & ; p = 2 \end{cases}$

Expected Return, $E(K_V) = K_{V_1} \times P_1 + K_{V_2} \times P_2$

$= 0.12726 \simeq 12.7\ \%$

Risk of investment

$\sigma_V = \sqrt{(0.1818 - 0.1273)^2 \times 0.8 + (-0.0909 - 0.1273)^2 \times 0.2}$

$\Rightarrow \sigma_V = \sqrt{0.0023762 + 0.009522248}$

$\sigma_V = 0.10908007 \simeq 10.9\ \%$

Q2) Given, $B(0) = Rs\ 90$

$B(1) = Rs.\ 100$

$S(0) = Rs.25$, $S(1) = \begin{cases} Rs\ 30 & , p \\ Rs\ 20 & , 1-p \end{cases}$

for $x = 10$ shares & $y = 15$ bonds

$V(0) = x\,S(0) + y\,B(0)$

$V(0) = 10 \times 25 + 15 \times 90$

$= Rs.\ 1600$

$V(1) = \begin{cases} 10 \times 30 + 15 \times 100 = Rs\,1800 & , p \\ 10 \times 20 + 15 \times 100 = Rs\,1700 & , 1-p \end{cases}$

Return of this portfolio is given by

$K_v = \begin{cases} \frac{1800-1600}{1600} = 0.125 \text{ or } 12.5\%, \text{ with prob } p \\ \frac{1700-1600}{1600} = 0.0625 \text{ or } 6.25\%, \text{ with prob } 1-p \end{cases}$

Expected Return

$E(K_v) = 0.125 \times p + 0.0625(1-p)$

Ques3→ Given, $B(0) = Rs\ 100$

$B(1) = Rs.\ 110$

$S(0) = 80 Rs.$ $\quad S(1) = \begin{cases} Rs\ 100, & \text{with } p = 0.8 \\ Rs\ 60, & \text{with } p = 0.2 \end{cases}$

given initial wealth, $V(0) = 10,000$

$x = y$

$V(0) = 5x + 50x(100)$.

$100 \times y = 5000$

$y = 50$

$80 \times x = 5000$

$x = \frac{5000}{8} = \frac{125}{2}$

$V(1) = \begin{cases} \frac{125}{2} \times 100 + 50 \times 110 \\ = Rs\ 11750 \quad \text{with } p = 0.8 \\ \frac{125}{2} \times 60 + 50 \times 110 \\ = Rs\ 9250 \quad \text{with } p = 0.2 \end{cases}$

$K_V = \begin{cases} \frac{1750}{10000} = 0.175 & \text{with } p = 0.8 \\ -0.075 & \text{with } p = 0.2 \end{cases}$

Expected Return $= 0.175 \times 0.8 + (-0.075 \times 0.2)$

$= 0.125 \simeq 12.5\%$

Risk of Investment $\Rightarrow \sigma_V^2 = (0.175 - 0.125)^2 \times 0.8$

$+ (-0.075 - 0.125)^2 \times 0.2$

$= \sqrt{0.002 + 0.04} = 0.084$

$\simeq 8.4\%$

Q4→ Given, $B(0) = ₹90$

$B(1) = ₹100$

$S(0) = ₹25$ & $S(1) = \begin{cases} ₹30, & \text{with prob } p \\ ₹20, & \text{with prob } 1-p \end{cases}$

& $V(1) = \begin{cases} ₹1,160, & \text{if stock goes down} \\ ₹1040, & \text{if stock goes up} \end{cases}$

Let x be no. of shares & y be no. of bonds bought

$V(0) = (x \times 25) + (y \times 90)$ — ①

Also,

$30x + 100y = 1160$ — ②

$20x + 100y = 1040$ — ③ } from V(1)

upon solving,

$\underline{x = 12}$ & $\underline{y = 8}$

∴ Value of portfolio at time 0 is given by.

$V(0) = 12 \times 25 + 8 \times 90$

$= ₹. 1,520$