

3. There are two equally likely states. The returns on the market portfolio, the risk-free return, Oracle Co. and Delta Airlines are as follows:

	State 1	State 2
Market Portfolio	0	20%
Risk-Free Return	5%	5%
Oracle	-5%	?
Delta Airlines	10%	-10%

- Compute the expected return and standard deviation of Delta Airlines.
- Can you duplicate the payoff of Delta Airlines using the market portfolio and the risk-free return? What are the weights of each in this portfolio?
- If Oracle has a beta of 2, what is its return in State 2?
- Duplicate the payoff of Oracle using the market portfolio and the risk-free asset.

$$(a) \bar{R}_{\text{DELTA}} = \frac{10\% + (-10\%)}{2} = 0\%$$

$$\sigma_{\text{DELTA}} = 10\%$$

(b) -100% in the market and 200% in the risk-free asset give:

$$\text{State 1 portfolio return: } (-100\%) \cdot 0 + (200\%) \cdot 5 = 10$$

which is the same as Delta's return in state 1.

$$\text{State 2 portfolio return: } (-100\%) \cdot 20 + (200\%) \cdot 5 = -20 + 10 = -10$$

which is again the same as Delta's return in state 2.

(c) If β_{ORACLE} equals 2, then from CAPM

$$\bar{R}_{\text{ORACLE}} = 5 + 2(\bar{R}_{\text{market}} - 5), \quad \text{where } \bar{R}_{\text{market}} = \frac{0 + 20}{2} = 10\%$$

$$\bar{R}_{\text{ORACLE}} = 5 + 2(10 - 5) = 15\%$$

$$\text{From expected return formula, } \bar{R}_{\text{ORACLE}} = \frac{-5\% + X\%}{2} = 15\%$$

Solve for X: $X = 35\%$, which is Oracle's return in state 2.

(d) Similar to part (b).

Oracle is duplicated with 200% in the market portfolio and -100% in the risk-free asset:

$$\text{State 1: } (200\%) \cdot 0 + (-100\%) \cdot 5 = 0 - 5 = -5\%$$

$$\text{State 2: } (200\%) \cdot 20 + (-100\%) \cdot 5 = 40 - 5 = 35\%$$