Calculation Example

Q1) Find the discrete yearly returns of stocks CBA and BHP from the following price data.

Date	**Adjusted Closing Price ($)**	
	CBA	**BHP**
1/1/2007	48.39	25.17
2/1/2008	47.77	36.31
2/1/2009	26.01	30.11
4/1/2010	51.47	38.9
4/1/2011	52.46	44.25

To find CBA's return from 2010 to 2011,

$$r_{CBA,2010\to2011} = \frac{p_{4/1/2011}}{p_{4/1/2010}} - 1$$

$$= \frac{52.46}{51.47} - 1 = 0.0192$$

And so on. Here are the complete results:

Date	**Return (p.a.)**	
	CBA	**BHP**
1/1/2007		
2/1/2008	-0.0128	0.4426
2/1/2009	-0.4555	-0.1708
4/1/2010	0.9789	0.2919
4/1/2011	0.0192	0.1375

Q2) Calculate the arithmetic mean, variance and standard deviation of returns.

$$\bar{r}_{\substack{CBA,\\ 2007\to\\ 2011,pa}} = \frac{r_{CBA,07\to08} + r_{CBA,08\to09} + r_{CBA,09\to10} + r_{CBA,10\to11}}{n}$$

$$= \frac{-0.0128 - 0.4555 + 0.9789 + 0.0192}{4} = 0.1324$$

$$var(r) = \sigma^2 = \frac{\sum_{i=1}^{n}[(r_i - \bar{r})^2]}{n-1}$$

$$\sigma^2_{CBA,2007\to2011,p.a.} = \frac{\begin{bmatrix} (-0.0128 - 0.1324)^2 + \\ (-0.4555 - 0.1324)^2 + \\ (0.9789 - 0.1324)^2 + \\ (0.0192 - 0.1324)^2 \end{bmatrix}}{4-1} = 0.3653$$

$$\sigma^2_{CBA,2007\to2011,p.a.} = 0.3653$$

$$\sigma_{CBA,2007\to2011,p.a.} = \sqrt{0.3653}$$

$$= 0.6044$$

Similarly for BHP. Here are the complete results:

	CBA	**BHP**
Return	0.1324	0.1753
Variance	0.3653	0.0687
St. dev.	0.6044	0.2622

Q3) Calculate the covariance and correlation of their returns.

$$cov(r_A, r_B) = \sigma_{A,B} = \frac{\sum_{i=1}^{n}\left[\left(r_{A,i} - \bar{r}_A\right)\left(r_{B,i} - \bar{r}_B\right)\right]}{n-1}$$

$$\sigma_{CBA,BHP,2007\rightarrow2011,p.a.} =$$

$$\frac{\begin{bmatrix} (-0.0128 - 0.1324) \times (0.4426 - 0.1753) + \\ (-0.4555 - 0.1324) \times (-0.1708 - 0.1753) + \\ (0.9789 - 0.1324) \times (0.2919 - 0.1753) + \\ (0.0192 - 0.1324) \times (0.1375 - 0.1753) + \end{bmatrix}}{4-1}$$

$$\sigma_{CBA,BHP,2007\rightarrow2011,p.a.} = 0.0892$$

$$correl(r_1, r_2) = \rho_{1,2} = \frac{cov(r_1, r_2)}{sd(r_1).sd(r_2)} = \frac{\sigma_{1,2}}{\sigma_1.\sigma_2}$$

$$\rho_{CBA,BHP,2007-2011,p.a.} = \frac{0.0892}{0.6044 \times 0.2622}$$

$$= 0.5629$$

	CBA	BHP
Covariance	0.0892	
Correlation	0.5629	

In conclusion, BHP has a higher return and lower risk than CBA. The correlation is not near one so a fair amount of diversification is possible.