***Constructing the 2-stock Markowitz Bullet***

* In a two-stock world, the combination line is the Markowitz bullet.
* The line passes through the 2 stocks on the return-standard deviation graph.



***Calculation Example***

Q) Using the information in the diagram, find the variance of a portfolio with a target return of 0.18. Assume $ρ\_{1,2}=0.3$.

A) There are 2 steps:

1. Find the weight in stock 1 that yields the given return using the portfolio return equation:

$$r\_{P}=x\_{1}.r\_{1}+x\_{2}.r\_{2}$$

Together with the ‘weights sum to one’ equation:

$x\_{1}+x\_{2}=1$, so $x\_{2}=1-x\_{1}$

So,

$$r\_{P}=x\_{1}.r\_{1}+\left(1-x\_{1}\right).r\_{2}$$

$$0.18=x\_{1}×0.1+\left(1-x\_{1}\right)×0.2$$

After solving to find $x\_{1}$,

$$x\_{1}=0.2$$

Therefore

$$x\_{2}=1-0.2=0.8$$

These weights make sense since the target return of 0.18 is between stock 1 and 2’s returns so we should be long both stocks, which we are since both weights are positive.

1. Now calculate the portfolio variance by substituting the weights $x\_{1}$ and $x\_{2}$ into the portfolio variance equation:

$$σ\_{P}^{2}=x\_{1}^{2} .σ\_{1}^{2}+x\_{2}^{2} .σ\_{2}^{2}+2.x\_{1}.x\_{2}.ρ\_{1,2}.σ\_{1}.σ\_{2}$$

$$ =\begin{matrix}0.2^{2}×0.15^{2}+0.8^{2}×0.25^{2}+\\2×0.2×0.8×0.3×0.15×0.25\end{matrix}$$



$$ =0.0445$$

$$σ\_{P} =0.2110$$