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Solution to activities

Activity 1.1

*From Certificate of Incorporation of Alphabet*

This Corporation is authorized to issue nine billion (9,000,000,000) shares of Class A Common Stock, par value $0.001 per share (the “Class A Common Stock”), three billion (3,000,000,000) shares of Class B Common Stock, par value $0.001 per share (the “Class B Common Stock”, and together with the Class A Common Stock, the “Common Stock”), three billion (3,000,000,000) shares of Class C Capital Stock, par value $0.001 per share (the “Class C Capital Stock”), and one hundred million (100,000,000) shares of Preferred Stock, par value $0.001 per share. The number of authorized shares of any class or classes of stock may be increased or decreased (but not below the number of shares thereof then outstanding) by the affirmative vote of the holders of at least a majority of the voting power of the issued and outstanding shares of Common Stock of the Corporation, voting together as a single class.

Except as otherwise provided herein or by applicable law, the holders of shares of Class A Common Stock and Class B Common Stock shall at all times vote together as one class on all matters (including the election of directors) submitted to a vote or for the consent of the stockholders of the Corporation. (ii) Each holder of shares of Class A Common Stock shall be entitled to one (1) vote for each share of Class A Common Stock held as of the applicable date.

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1 https://www.sec.gov/Archives/edgar/data/1652044/000119312515336577/d82837dex31.htm
on any matter that is submitted to a vote or for the consent of the stockholders of the Corporation. (iii) Each holder of shares of Class B Common Stock shall be entitled to ten (10) votes for each share of Class B Common Stock held as of the applicable date on any matter that is submitted to a vote or for the consent of the stockholders of the Corporation.

Dividends. Subject to the preferences applicable to any series of Preferred Stock, if any, outstanding at any time, the holders of Class A Common Stock and the holders of Class B Common Stock shall be entitled to share equally, on a per share basis, in such dividends and other distributions of cash, property or shares of stock of the Corporation as may be declared by the Board of Directors from time to time with respect to the Common Stock out of assets or funds of the Corporation legally available therefor; provided, however, that in the event that such dividend is paid in the form of shares of Common Stock or rights to acquire Common Stock, the holders of Class A Common Stock shall receive Class A Common Stock or rights to acquire Class A Common Stock, as the case may be, and the holders of Class B Common Stock shall receive Class B Common Stock or rights to acquire Class B Common Stock, as the case may be.

The Alphabet 2016 annual report includes the following details:

Our Class B common stock has 10 votes per share, our Class A common stock has one vote per share, and our Class C capital stock has no voting rights. As of December 31, 2016, Larry [Page], Sergey [Brin], and Eric [Schmidt] beneficially owned approximately 92.4% of our outstanding Class B common stock, which represented approximately 56.8% of the voting power of our outstanding capital stock.2

Therefore, while Alphabet’s founders Larry Page and Sergey Brin (and founding CEO Eric Schmidt) may no longer have majority ownership of Alphabet’s stock, they are able to maintain control due to the complex share structure of A, B and C shares.

2 The 2016 annual report can be obtained from the Alphabet investor relations website available at https://abc.xyz/investor/pdf/2016_google_annual_report.pdf
Activity 1.2

23 June 2016 – 17,333.5
24 June 2016 – 16,088.10

Hence the FTSE250, which is predominantly made up of UK companies, fell by 7% as a result of the referendum held on 23 June 2016 regarding the UK’s membership of the EU. The drop in the index reflects what the market believes are the implications for the UK economy of leaving the EU, and the implications for these companies in particular. As an aside, many students may be asking why, in that case, the index has risen since? One possible explanation is that the exchange rate has fallen, which makes UK goods cheaper to overseas buyers. For example, on 23 June 2016 the USD/GBP exchange rate was US$1.4789/GBP, but by 3 January 2017 it had fallen to US$1.2282/GBP.

Activity 1.3

Up to October 2017, Microsoft has split its stock nine times, with six 2-for-1 splits and three 3-for-1 splits. After the most recent split, in 2003, one original share equals 288 shares. The current share price can be found at:

https://uk.finance.yahoo.com/quote/MSFT/

As of 2 October 2017, the price was US$77.91. Multiplying this by 288, we obtain US$22,438.08, which represents a percentage return of 106,748% relative to the initial offer price of US$21 in March 1986.

Activity 2.1

Following the approach taken in section 2.1 we find the correlation to be –0.2873. This is not surprising given that crude oil is a major factor in the cost structure of an airline.

The solution to this exercise can be found here. Please ensure you click on Activity Solutions and the Activity 2.1 tab at the bottom of the spreadsheet.

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Activity 2.2

The beta of Tesla is 1.41, but the interesting point is that the $r^2$-squared is only 11.8%, indicating that Tesla is exposed to significantly more unique risks than market risks.

The solution to this exercise can be found [here](#). Please ensure you click on Activity Solutions and the Activity 2.2 tab at the bottom of the spreadsheet.

Activity 2.3

Value of portfolio = $10,000 \times 12.15 + 10,000 \times 49.53 + 10,000 \times 88.55 = 121,000 + 495,300 + 885,500 = 1,501,800$

Weight in each:

$121,000/1,501,800 = 8.06\%, 495,300/1,501,800 = 32.98\%, 885,500/1,501,800 = 58.96\%$

Beta of portfolio = $0.0806 \times 1.13 + 0.3298 \times 0.71 + 0.5896 \times 0.52 = 0.65$

A common mistake in this exercise is to use the weights of $1/3$, $1/3$ and $1/3$, as the portfolio includes 10,000 of each stock. However, this does not reflect the fact that the stock's prices are all different and hence the wealth invested in each asset differs.
The solution to this exercise can be found here. Please ensure you click on Activity Solutions and the Activity 2.3 tab at the bottom of the spreadsheet.

**Activity 3.1**

At the time of writing (October 2017):

- **Highest**: 31 March 2017 – 168.50, \( r = \frac{8}{168.50} = 4.7\% \)
- **Lowest**: 30 June 2016 – 138.875, \( r = \frac{8}{138.75} = 5.8\% \)

The solution to this exercise can be found here. Please ensure you click on Activity Solutions and the Activity 3.1 tab at the bottom of the spreadsheet.

**Activity 3.2**

**Alphabet**

“We have never declared or paid any cash dividend on our common or capital stock. We intend to retain any future earnings and do not expect to pay any cash dividends in the foreseeable future.”

(Alphabet Annual report, 2016, page 17)

**Amazon**

“We have never declared or paid cash dividends on our common stock.”

(Amazon Annual report, 2016, page 16)

**Imperial Brands**

“The Board is pleased to be recommending a total dividend for the year of 155.2 pence per share, another strong increase of 10 per cent. This is the eighth consecutive year that we have delivered dividend growth of 10 per cent and we are committed to maintaining this annual growth rate over the medium term.”

(Imperial Tobacco Annual report, 2016, page 2)

Imperial Brands dividend history is also detailed at http://www.imperialbrandsplc.com/Investors/Shareholder-centre/Dividends-history.html.
Activity 4.1

<table>
<thead>
<tr>
<th>Par</th>
<th>€1,000</th>
</tr>
</thead>
</table>

**Coupon**
- 5.00% <<You can edit this cell. The default is 5%>

**YTM**
- 10.00% <<You can edit this cell. The default is 10%>

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV</th>
<th>t x PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>€50.00</td>
<td>€45.45</td>
<td>€45.45</td>
</tr>
<tr>
<td>2</td>
<td>€50.00</td>
<td>€41.32</td>
<td>€82.64</td>
</tr>
<tr>
<td>3</td>
<td>€1,050</td>
<td>€788.88</td>
<td>€2,366.64</td>
</tr>
</tbody>
</table>

**Price**
- €875.66 2,494.74 << = sum of t xPV

\[ D = \frac{1 \times \left(\frac{€50}{1.1}\right) + 2 \times \left(\frac{€50}{1.1^2}\right) + 3 \times \left(\frac{€1050}{1.1^3}\right)}{\left(\frac{€50}{1.1}\right) + \left(\frac{€50}{1.1^2}\right) + \left(\frac{€1050}{1.1^3}\right)} \]

\[ = \frac{1 \times 45.45 + 2 \times 41.32 + 3 \times 788.88}{45.45 + 41.32 + 788.88} \]

\[ = \frac{2,494.73}{875.65} = 2.85 \]

Activity 5.1

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow</td>
<td>$60,000</td>
<td>$25,000</td>
<td>$25,000</td>
<td>$25,000</td>
</tr>
<tr>
<td>Cumulative cash flow</td>
<td>$60,000</td>
<td>$35,000</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Payback</td>
<td>2.4 years</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After two years this project still needs to return a further $10,000. As $25,000 of cash flows accrue in year 3, the payback is then \( 2 + \left| \frac{-10,000}{25,000} \right| = 2.4 \text{ years} \).
After two years the project still needs to return a further $13,514.74. As $21,595.94 of present value of cash flows accrue in year 3, the payback is then $2 + \frac{-13,514.74}{21,595.94} = 2.54 \text{ years}.

For any positive discount rate the present value of a cash flow is less than the actual level of the cash flow, hence it follows that modified payback is greater than simple payback.

The solution to this exercise can be found here. Please ensure you click on Activity Solutions and the Activity 5.1 tab at the bottom of the spreadsheet.

### Activity 6.1

<table>
<thead>
<tr>
<th>Beta</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rf</td>
<td>2%</td>
</tr>
<tr>
<td>E(Rm) – Rf</td>
<td>4%</td>
</tr>
<tr>
<td>Cost of equity = E(Ri)</td>
<td>10%</td>
</tr>
<tr>
<td>Price</td>
<td>610</td>
</tr>
<tr>
<td>Par</td>
<td>1000</td>
</tr>
<tr>
<td>T</td>
<td>5</td>
</tr>
<tr>
<td>Coupon</td>
<td>0</td>
</tr>
</tbody>
</table>

\[
\text{Price} = \frac{\text{Par}}{(1 + \text{YTM})^T}
\]

\[
\text{Cost of debt} = \text{YTM} = \left(\left(\frac{\text{par}}{\text{price}}\right)^{\frac{1}{T}} - 1\right) = 10.39\%
\]

| Tax rate | 23% |
| Cost of debt after tax | 8% |
\[ K_{WACC} = \left[ K_E + K_{DAT} \times \frac{D}{E} \right] / \left[ 1 + \frac{D}{E} \right] = \left[ 0.1 + 0.08 \times \frac{1}{1} \right] / \left[ 1 + \frac{1}{1} \right] = 0.09 = 9\% \]

The solution to this exercise can be found here. Please ensure you click on Activity Solutions and the Activity 6.1 tab at the bottom of the spreadsheet.

**Activity 7.1**

\[
F_{12/12}(DKK/EUR) = \frac{S(DKK/EUR) \times (1 + i_{DKK})}{(1 + i_{EUR})} = \frac{7.4422 \times (1 + 0.015)}{1 + 0.0122} = 7.401 \text{ DKK/EUR}
\]

The solution to this exercise can be found here. Please ensure you click on Activity Solutions and the Activity 7.1 tab at the bottom of the spreadsheet.

**Activity 8.1**

<table>
<thead>
<tr>
<th>Exposure = 200,000 bushels</th>
</tr>
</thead>
<tbody>
<tr>
<td>FV = 5,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of contracts</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial basis</td>
<td>-10</td>
</tr>
<tr>
<td>Final basis</td>
<td>0</td>
</tr>
<tr>
<td>Go long at</td>
<td>872 cents per bushel</td>
</tr>
<tr>
<td>Spot</td>
<td>862 cents per bushel</td>
</tr>
<tr>
<td>Expected cost</td>
<td>$1,724,000</td>
</tr>
</tbody>
</table>
When the price of wheat rises, and the spot and futures prices converge, then the spot rate rises by a larger proportion than the futures prices. Hence the change in cost is larger than the profit on the futures position, and the hedge efficiency is less than 100%. However, when the prices fall (and converge), the spot price falls less than the futures price, and the hedge efficiency is greater than 100%.

If the basis remains constant at –10, the hedge efficiency is 100% as the spot and futures prices have moved in tandem.

The solution to this exercise can be found here. Please ensure you click on Activity Solutions and the Activity 8.1 tab at the bottom of the spreadsheet.
Here to reduce the cost of the hedge, the company sells a put option with a lower strike price than the call option. If the holder exercises, they will be forced to buy (reluctantly) at US$1.40/GBP, though they would rather buy more cheaply in the spot market. The net effect is that the company creates a maximum cost and a minimum cost.

The solution to this exercise can be found here. Please ensure you click on Activity Solutions.