

Mini Case: Royal Bank of Canada

NB the calculation shown here uses 2 SDs for 95% range. If students use 1.96 SDs, that is also correct.

PLAN	Setup: State the objective	Project future revenues and expenses for the five RBC business segments.																																																																																		
DO	<p>Mechanics:</p> <p>Assuming that your projections are Normally distributed, and that all of the revenues and expenses for each segment are uncorrelated, calculate dollar values for your projections for total revenue and total expenses over all five segments, and for net income = revenue – expenses for the total of the five segments.</p>	<p>In order to add the projections to get the projection of total revenue and total expenses, we need to calculate the variance of the projection of each of the segments, since we can add variances. In order to get the variance, we first calculate the standard deviations of the projection for each segment. As an example, the upper limit for Personal & Commercial Banking expenses is $7237 + 2 * SD$ by our 68-95-99.7 rule. Therefore $SD = 0.5 * 0.12 * 7237 = 434.22$. Therefore $variance = 434.22^2 = 188547$.</p> <p>(2 marks)</p> <p>Assuming no correlation</p> <p>Repeating this calculation for each segment we obtain:</p> <table border="1" data-bbox="418 766 1539 1480"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Mean</th> <th colspan="2">Standard Deviation</th> <th colspan="2">Variance</th> </tr> <tr> <th>Revenue</th> <th>Expenses</th> <th>Revenue</th> <th>Expenses</th> <th>Revenue</th> <th>Expenses</th> </tr> </thead> <tbody> <tr> <td>Personal & Commercial Banking</td> <td>13223</td> <td>7237</td> <td>793.38</td> <td>434.22</td> <td>629451.8</td> <td>188547</td> </tr> <tr> <td>Wealth Management</td> <td>5487</td> <td>4252</td> <td>329.22</td> <td>255.12</td> <td>108385.8</td> <td>65086.21</td> </tr> <tr> <td>Insurance</td> <td>3928</td> <td>3333</td> <td>235.68</td> <td>199.98</td> <td>55545.06</td> <td>39992</td> </tr> <tr> <td>Investor and Treasury Services</td> <td>1804</td> <td>1343</td> <td>162.36</td> <td>120.87</td> <td>26360.77</td> <td>14609.56</td> </tr> <tr> <td>Capital Markets</td> <td>6580</td> <td>4032</td> <td>592.2</td> <td>362.88</td> <td>350700.8</td> <td>131681.9</td> </tr> <tr> <td colspan="7">(1.5 marks)</td> </tr> <tr> <td>Total</td> <td>31022</td> <td>20197</td> <td>1081.871</td> <td>663.262146</td> <td>1170444</td> <td>439916.7</td> </tr> <tr> <td>plus/minus (\$m)</td> <td>2163.741</td> <td>1326.524</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>plus/minus (%)</td> <td>6.97%</td> <td>6.57%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>The projection for the total is obtained by adding the means and the variances. The standard deviations are the square root of the variances. For instance the SD for Revenue is $SQRT(439917) = 663.26$. The range of 95% confidence on the projections is given by plus/minus two standard deviations. For instance the projection for total revenue is 31022 plus/minus $2 * 663.26$, i.e. 31022 plus/minus 6.97%.</p> <p>(1 mark)</p> <p>The projection for net income is obtained calculating net income = revenue – expenses (N=R-E) and totalling for each segment.</p> <table border="1" data-bbox="418 1879 933 1976"> <thead> <tr> <th>Revenue</th> <th>Expenses</th> <th>Net Income</th> </tr> </thead> <tbody> <tr> <td>13223</td> <td>7237</td> <td>5986</td> </tr> </tbody> </table>		Mean		Standard Deviation		Variance		Revenue	Expenses	Revenue	Expenses	Revenue	Expenses	Personal & Commercial Banking	13223	7237	793.38	434.22	629451.8	188547	Wealth Management	5487	4252	329.22	255.12	108385.8	65086.21	Insurance	3928	3333	235.68	199.98	55545.06	39992	Investor and Treasury Services	1804	1343	162.36	120.87	26360.77	14609.56	Capital Markets	6580	4032	592.2	362.88	350700.8	131681.9	(1.5 marks)							Total	31022	20197	1081.871	663.262146	1170444	439916.7	plus/minus (\$m)	2163.741	1326.524					plus/minus (%)	6.97%	6.57%					Revenue	Expenses	Net Income	13223	7237	5986
	Mean			Standard Deviation		Variance																																																																														
	Revenue	Expenses	Revenue	Expenses	Revenue	Expenses																																																																														
Personal & Commercial Banking	13223	7237	793.38	434.22	629451.8	188547																																																																														
Wealth Management	5487	4252	329.22	255.12	108385.8	65086.21																																																																														
Insurance	3928	3333	235.68	199.98	55545.06	39992																																																																														
Investor and Treasury Services	1804	1343	162.36	120.87	26360.77	14609.56																																																																														
Capital Markets	6580	4032	592.2	362.88	350700.8	131681.9																																																																														
(1.5 marks)																																																																																				
Total	31022	20197	1081.871	663.262146	1170444	439916.7																																																																														
plus/minus (\$m)	2163.741	1326.524																																																																																		
plus/minus (%)	6.97%	6.57%																																																																																		
Revenue	Expenses	Net Income																																																																																		
13223	7237	5986																																																																																		

		<p>5487 4252 1235</p> <p>3928 3333 595</p> <p>1804 1343 461</p> <p>6580 4032 2548</p> <p>31022 20197 10825</p> <p> plus/minus (\$m) 2537.99998</p> <p> plus/minus (%) 23.45%</p> <p>Even though we subtract $N=R-E$, the variance adds: $Var(N) = Var(R) + Var(E)$ $SD(N) = \text{Sqrt}(1170444+439917)$ The projection for net income is therefore 10825 plus/minus $2 * SD(N)$, i.e. 10825 plus/minus 23.45%.</p>
REPORT	Conclusion: State the conclusion in the context of the original objective.	<p>Our projections are: Revenue: \$31022m plus/minus 6.97% Expenses: \$20197m plus/minus 6.57% Net Income: \$10825m plus/minus 23.45% (0.5 marks for reason) The percentages vary since the ranges for all these projections are given as percentages of different means. The percentage range on net income is much larger than the others since it is a percentage of a smaller number 10825 compared to 20197 and 31022.</p>

(1.0 marks bonus for PLAN/DO/REPORT format)

Note to TAs for marking

The above calculation uses the 68-95-99.7 rule for mean plus/minus 2SD having a probability of 0.95. Alternatively a more exact calculation would use mean plus/minus 1.96SD having a probability of 0.95.

Please mark either method correct.