Q.1 Pretax profits

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Yes, If Sarah is referring to earnings before interest and taxes. Also, this conclusion is based on certain assumptions; such as variable cost per unit does not change with selling price.

Selling Price/unit		$ 7.00	$ 8.00	$ 9.00
Unit variable cost/unit		$ 3.32	$ 3.32	$ 3.32
Expected sales units	In thousands	89.00	69.90	57.50
Sales	In thousands $	$ 623.00	$ 559.20	$ 517.50
Variable costs		$ (295.48)	$ (232.07)	$ (190.90)
Contribution Margin		$ 327.52	$ 327.13	$ 326.60
Fixed costs		$ (141.00)	$ (141.00)	$ (141.00)
EBIT		$ 186.52	$ 186.13	$ 185.60

Q.2 Break-even Analysis

Selling price per unit	$ 7.00	$ 8.00	$ 9.00
Contribution Margin per unit	$ 3.68	$ 4.68	$ 5.68
Fixed costs	$ 141.00	$ 141.00	$ 141.00
Break-even (units)	38.32	30.13	24.82
Safety margin	50.68	39.77	32.68
(Break-even / expected sales)			
Safety margin %	56.95%	56.90%	56.83%

Q.3 Investment Required

The amounts invested in each strategy vary because of different working capital needs. They could also vary if Sarah could purchase a smaller plant or lease excess capacity.

Assumptions:	Selling Price/unit		$ 7.00	$ 8.00	$ 9.00
Varies With Units Sold	Cash	In thousands $	$ 50.00	$ 39.27	$ 32.30
Varies With Sales $	Receivables		$ 207.67	$ 186.40	$ 172.50
Varies With Units Sold	Inventories		$ 98.49	$ 77.36	$ 63.63
	Working Capital		$ 356.16	$ 303.03	$ 268.44
Fixed	Plant & Equipment		$ 500.00	$ 500.00	$ 500.00
	Total Investment		$ 856.16	$ 803.03	$ 768.44

Q.4 Gross return (= EBIT/Assets)

Selling Price/unit			$ 7.00	$ 8.00	$ 9.00
EBIT		In thousands $	186.52	186.13	185.60
Total Investment		Invstmt	856.16	803.03	768.44
Gross Return			21.79%	23.18%	24.15%
NOPAT = Net Operating Profit After Taxes =					
EBIT	×[100.00% - 40.00%]		= 111.91	111.68	111.36
Return on Assets	EBIT ÷	Invstmt	= 13.07%	13.91%	14.49%

Q.5 Accounting measures for project evaluation

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5a. Earnings per share

Her rule appears to be: if EPS goes up with the project, then select the project. Although this measure is very popular in practice, it has some potential problems. However, these problems can be alleviated.

A common error is to ignore the additional equity that is required when investments are made, and to compare two EPS numbers that are not comparable because of differences in dividend policy. Saying "I don't need to issue new equity to finance this project" will give you the wrong answer. If, for example, we kept the number of shares outstanding the same, we would accept any project that showed a positive accounting profit, since it would increase EPS. Such a rule would be incorrect. To resolve this, we need to assume that the equity required for this project would be financed by issuing shares. To estimate the number of shares required, we need to first estimate the amount of equity required. The equity required is obtained by applying an appropriate mix of debt and equity to the investment required. Dividing the equity required by the share price gives the number of shares issued.

Since Wellesley's debt & equity market values are not known, we could use book values

In thousands $	1991	1990	Average
Interest expense	868		
Current portion of long-term debt	1,634	1,205	
Long term Debt	9,748	7,222	
Total debt	11,382	8,427	9,905

Average Interest rate = interest expense / total average debt 868 ÷ 9,905 = 8.76%

But this calculation ignores the interest that has to be paid on new loans. The appropriate calculation is

In thousands $	1991	1990	Increase
Interest expense	868	594	274
Current portion of long-term debt	1,634	1,205	
Long term Debt	9,748	7,222	
Total debt	11,382	8,427	2,955

Interest rate = Increase in Interest expense ÷ Increase in Total debt 274 ÷ 2,955 = 9.27%

Since we do not know the current share price, we have to estimate that from the statements.

Issue price		1991		1990		Increase	
Common stock		14,512		12,368		2,144	('000s)
Number of shares	÷	550		500		50	('000s)
Issue price		$ 26.39		$ 24.74		$ 42.88	
Rounded to						$ 43.00	
Tax rate							
Income tax expense		2,430		2,170		('000s)	
Earnings before taxes		6,146		5,489			
Tax rate		39.54%		39.53%	Rounded to	40.00%	

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Equity to capitalization				
Total debt	11,382	8,427	('000s)	
Equity	35,721	31,921		
Capitalization	47,103	40,348		
Equity to capitalization	75.84%	79.11%	Rounded to	75.00%

The first year income statement can now be computed for each strategy.

Selling Price/unit				$ 7.00	$ 8.00	$ 9.00
Total Investment				856.16	803.03	768.44
Equity	75.00%			642.12	602.27	576.33
Debt	25.00%			214.04	200.76	192.11
New shares =	Equity	÷	$43.00	14.93	14.01	13.40
EBIT				186.52	186.13	185.60
Interest	10.00%	of debt		(21.40)	(20.08)	(19.21)
Earnings before taxes				165.12	166.06	166.39
Tax expense	40.00%			(66.05)	(66.42)	(66.56)
Net income				99.07	99.63	99.83
New shares issued			÷	14.93	14.01	13.40
Earnings per share				6.63	7.11	7.45
Net income	current			3,716.00	3,716.00	3,716.00
	from the project			99.07	99.63	99.83
	Total			3,815.07	3,815.63	3,815.83
Number of shares	current			550.00	550.00	550.00
	for the project			14.93	14.01	13.40
	Total			564.93	564.01	563.40
EPS if project is not undertaken				6.7564	6.7564	6.7564
EPS from the project				6.6343	7.1135	7.4486
EPS if project is undertaken				6.7531	6.7652	6.7728

The second problem with Sarah's rule is that we are comparing the project's EPS with the wrong benchmark. We should be comparing it with the cost of equity, not the current EPS. For example, a project could drop EPS and yet be profitable, just not as profitable as the existing portfolio of assets. To evaluate profitability, we need to compare EPS as a % of share value with the cost of equity.

Cost of equity 15.00%

Selling Price/unit					$ 6.00	$ 7.00	$ 8.00
EPS of the project /share price					15.43%	16.54%	17.32%
ROE: Net Income for the project/ New equity					15.43%	16.54%	17.32%
Current E/P ratio =	$6.7564	÷	$43.00	=	15.71%		

5b. Return on equity and Residual Income for equity

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The ROE computed in 5a is for the first year only, and two alternatives are to compute an average ROE over the life of the project or compute residual income. Consider the highest price alternative and compute average ROE and residual income for the project.

				plant original cost	÷	years				
		Depreciation expense	=	500	÷	5	=	100		

Table 5b.1

Year		1	2	3	4	5
Investment, beginning		768.44	668.44	568.44	468.44	368.44
Debt, beginning	25.00%	192.11	167.11	142.11	117.11	92.11
Equity Investment	75.00%	576.33	501.33	426.33	351.33	276.33

Table 5b.2 Residual Income for Equity

EBIT		185.60	185.60	185.60	185.60	185.60
Interest = debt x	10.00%	(19.21)	(16.71)	(14.21)	(11.71)	(9.21)
Earnings before taxes		166.39	168.89	171.39	173.89	176.39
Tax expense	40.00%	(66.56)	(67.56)	(68.56)	(69.56)	(70.56)
Net income		99.83	101.33	102.83	104.33	105.83
Capital charge for equity						
15.00% of equity		(86.45)	(75.20)	(63.95)	(52.70)	(41.45)
Residual income		$ 13.38	$ 26.13	$ 38.88	$ 51.63	$ 64.38
Present Value at						
15.00%	$ 118.50	$ 11.64	$ 19.76	$ 25.57	$ 29.52	$ 32.01
ROE		17.32%	20.21%	24.12%	29.70%	38.30%

5c Return On Sales.

This measure is very dangerous, because it seems reasonable but it could simply be an indicator of the pricing strategy: High markups and lower sales vs. low markups and more turnover. While a higher markup is always better if everything else is held constant, everything else is not constant.

The duPont analysis is more appropriate.

duPont Analysis						
			$ 7.00	$ 8.00	$ 9.00
ROI	= NOPAT / Investment	=	$111.91	$111.68	$111.36
Return On Investment			$ 856.16	$ 803.03	$ 768.44
=		=	13.07%	13.91%	14.49%
Return On Sales	= NOPAT / Sales	=	$111.91	$111.68	$111.36
			$623.00	$559.20	$517.50
		=	17.96%	19.97%	21.52%
×					
Turnover	Sales / Investment	=	$623.00	$559.20	$517.50
			$856.16	$803.03	$768.44
		=	72.77%	69.64%	67.34%

5c Return on Investment and Residual Income (EVA) for the firm 180401

	After tax cost		Cost		Weight		
After-tax cost of debt	60.00%	×	10.00%	x	25.00%	=	1.50%
Equity			15.00%	x	75.00%	=	11.25%
					WACC		12.75%

This assumed WACC, which is after taxes, is much more than the pre-tax gross ROA required by Wellesley. Remember, they compute ROA using earnings before interest but after taxes (NOPAT).

ROI in the first year (from Q. 4)		13.07%	13.91%	14.49%
Compare with WACC	12.75%	👍	👍	👍

Note, however that each year as the equipment decreases in value, the ROA goes up. This is because the asset's book value does not equal its market value (PV of remaining cash flows). One option is to use the average ROA. Another is to compute residual income and find the PV over the life of the project. Provided below is an example of how to compute these two for the strategy for the highest price:

EVA for the firm			1	2	3	4	5
NOPAT			111.36	111.36	111.36	111.36	111.36
Invested capital			768.44	668.44	568.44	468.44	368.44
ROI			14.49%	16.66%	19.59%	23.77%	30.23%
NOPAT			111.36	111.36	111.36	111.36	111.36
Capital charge	12.75%	×					
	Invested capital		(97.98)	(85.23)	(72.48)	(59.73)	(46.98)
Residual income; EVA			$ 13.38	$ 26.13	$ 38.88	$ 51.63	$ 64.38
Present value at							
12.75%	=	$ 126.84	$ 11.87	$ 20.56	$ 27.13	$ 31.95	$ 35.33
15.00%	=	$ 118.50	$ 11.64	$ 19.76	$ 25.57	$ 29.52	$ 32.01

The residual income method is the better option. Despite problems with book values, this method gives you the same decision as the NPV of cash flows method does (see Q. 6 later). Note how the asset investment declines each year, which assumes the excess cash is being returned to equity holders. The PV can be computed either using WACC or cost of equity capital. The latter is based on residual income belonging to equity holders.

Q.6 Cash flows and NPV for project evaluation for equity holders 180401

Year		0	1	2	3	4	5
Cash flow from operations							
Net income			99.83	101.33	102.83	104.33	105.83
Depreciation			100.00	100.00	100.00	100.00	100.00
Increase in working capital		(236.13)					236.13
CFO		(236.13)	199.83	201.33	202.83	204.33	441.97
Cash flow from Investing							
CFI		(500.00)					
Cash flow from financing							
New Debt (table 5b.1)		192.11	(25.00)	(25.00)	(25.00)	(25.00)	(92.11)
New Equity (table 5b.1)		576.33	(75.00)	(75.00)	(75.00)	(75.00)	(276.33)
Dividends [= Net Income]			(99.83)	(101.33)	(102.83)	(104.33)	(105.83)
CFI		703.83	(199.83)	(201.33)	(202.83)	(204.33)	(474.27)
Cash flow Total		32.30					(32.30)
Cash flow to equity holders [= dividends + New equity]		(576.33)	174.83	176.33	177.83	179.33	382.16
Present Value at 15.00%	=	(576.33)	152.03	133.33	116.93	102.53	190.00
NPV		118.50					

Note how the present value of the residual income is the same as the second PV in 5(b) above.

Free Cash flows and NPV for other options

Selling Price/unit	$ 7.00	$ 8.00	$ 9.00	$ 7.00	$ 8.00	$ 9.00
Investment in year 0				(856.16)	(803.03)	(768.44)
NOPAT	111.91	111.68	111.36			
Depreciation	100.00	100.00	100.00			
Free Cash Flow	211.91	211.68	211.36			
Present value of FCF annuity at		12.75%		749.91	749.09	747.96
Liquidation in year 5	356.16	303.03	268.44			
Present Value of liquidation at		12.75%		195.46	166.30	147.32
Net Present Value				$ 89.21	$ 112.36	$ 126.84

Q.7 ROA and divisional performance

180401

The divisional ROA measure is similar to gross ROA used for projects in that it is a return on assets, but it differs in 3 ways. First, it is an after-tax measure. Second, the earnings are reduced by allocated corporate expenses. Third, the assets in the denominator are increased by allocated corporate assets. If the allocated corporate expenses are primarily interest, there is a mismatch, since the numerator is after-interest, but the denominator is assets. Is divisional revenue a reasonable way to allocate corporate expenses and assets? Do all divisions provide the same tax benefits?

Q.8 Measures of divisional performance

Holding aside any differences between book and market value for assets, the best measure for divisional performance is ROE, because it combines the return on sales and ROA effects and considers leverage.

Income / Equity =	Income/Sales	x	Sales/assets	x	Assets/Equity	
ROE	=	Profit Margin	x	Asset Turnover	x	Financial Leverage
	=	ROA		x		Financial Leverage

Clearly, the three divisions are very different along the three dimensions, as shown by the table below

	Consumer	Industrial	Prof. Services	
Profit margin	hi	medium	low	
Asset turnover	medium	low	hi	
Financial leverage	medium	hi	low	a guess, based on the type of assets employed.
Risk	medium	low	high	also a guess, based on nature of the cash flows.

The first three can be controlled for using a return on equity measure. The last needs to be explicitly adjusted for. Again, using a residual income measure alleviates the problems due to differences between book and market value for assets and liabilities. To overcome the problem caused by accounting measures (ROA, etc.) varying from year to year, actual ROA could be compared against budgeted ROA. That is, we could plan to allow for low ROA during the early years of the project. In general, the measure used to evaluate projects should be similar to the one used to evaluate divisions.