

Part II

Solutions to website Learning Note questions

Learning notes 4.1 (contract costing) and 25.2 (the application of linear programming to capital budgeting) on the open access website include additional questions. Some of these questions contain solutions but others do not. The solutions to the questions in the latter category are provided in this section. For convenience the questions are also reproduced.

Thornfield Ltd is a building contractor. During its financial year to 30 June 2012, it commenced three major contracts. Information relating to these contracts as at 30 June 2012 was as follows:

Learning Note 4.1 (Question 3)

	Contract 1	Contract 2	Contract 3
Date contract commenced	1 July 2011	1 January 2012	1 April 2012
	(£)	(£)	(£)
Contract price	210 000	215 000	190 000
Expenditure to 30 June 2012:			
Materials and subcontract work	44 000	41 000	15 000
Direct wages	80 000	74 500	12 000
General expenses	3 000	1 800	700
Position at 30 June 2012			
Materials on hand at cost	3 000	3 000	1 500
Accrued expenses	700	600	600
Value of work certified	150 000	110 000	20 000
Estimated cost of work			
completed but not certified	4 000	6 000	9 000
Plant and machinery allocated to contracts	16 000	12 000	8 000

The plant and machinery allocated to the contracts was installed on the dates the contracts commenced. The plant and machinery is expected to have a working life of four years in the case of contracts 1 and 3 and three years in the case of contract 2, and is to be depreciated on a straight line basis assuming nil residual values.

Since the last certificate of work was certified on contract number 1, faulty work has been discovered which is expected to cost £10 000 to rectify. No rectification work has been commenced prior to 30 June 2012.

In addition to expending directly attributable to contracts, recoverable central overheads are estimated to amount to 2% of the cost of direct wages.

Thornfield Ltd has an accounting policy of taking two thirds of the profit attributable to the value of work certified on a contract, once the contract is one third completed. Anticipated losses on contracts are provided in full.

Progress claims equal to 80% of the value of work certified have been invoiced to customers.

You are required to:

- prepare contract accounts for each contract for the year to 30 June 2012, calculating any attributable profit or loss on each contract; (12 marks)
- calculate the amount to be included in the balance sheet of Thornfield Ltd as on 30 June 2012 in respect of these contracts. (4 marks)

Total 16 marks)

ICAEW Accounting Techniques

Learning Note 4.1 (Question 4)

- (a) PZ plc undertakes work to repair, maintain and construct roads. When a customer requests the company to do work PZ plc supplies a fixed price to the customer and allocates a works order number to the customer's request. This works order number is used as a reference number on material requisitions and timesheets to enable the costs of doing the work to be collected.

PZ plc's financial year ends on 30 April. At the end of April 2012 the data shown against four of PZ plc's works orders were:

Works order number	488	517	518	519
Date started	1/3/11	1/2/12	14/3/12	18/3/12
Estimated completion date	31/5/12	30/7/12	31/5/12	15/5/12
	(£000)	(£000)	(£000)	(£000)
Direct labour costs	105	10	5	2
Direct material costs	86	7	4	2
Selling price	450	135	18	9
Estimated direct costs to complete orders:				
Direct labour	40	60	2	2
Direct materials	10	15	1	1
Independent valuation of work done up to 30 April 2012	350	30	15	5

Overhead costs are allocated to works orders at the rate of 40% of direct labour costs.

It is company policy not to recognize profit on long-term contracts until they are at least 50% complete.

Required:

- State, with reasons, whether the above works orders should be accounted for using contract costing or job costing. (4 marks)
 - Based on your classification at (i) above, prepare a statement showing *clearly* the profit to be recognized and balance sheet work in progress valuation of *each* of the above works orders in respect of the financial year ended 30 April 2012. (10 marks)
 - Comment critically on the policy of attributing overhead costs to works orders on the basis of direct labour cost. (6 marks)
- (b) Explain the main features of process costing. Describe what determines the choice between using process costing or specific order costing in a manufacturing organization. (10 marks)

(Total 30 marks)

CIMA Operational Cost Accounting Stage 2

Learning Note 25.2 (Question 4)

Raiders Ltd is a private limited company which is financed entirely by ordinary shares. Its effective cost of capital, net of tax, is 10% per annum. The directors of Raiders Ltd are considering the company's capital investment programme for the next two years, and have reduced their initial list of projects to four. Details of the projects are as follows:

Cash flows (net of tax)						
	Immediately (£000)	After one year (£000)	After two years (£000)	After three years (£000)	Net present value (at 10%) (£000)	Internal rate of return (to nearest 1%)
Project						
A	−400	+50	+300	+350	+157.0	26
B	−300	−200	+400	+400	+150.0	25
C	−300	+150	+150	+150	+73.5	23
D	0	−300	+250	+300	+159.5	50

None of the projects can be delayed. All projects are divisible; outlays may be reduced by any proportion and net inflows will then be reduced in the same proportion. No project can be undertaken more than once. Raiders Ltd is able to invest surplus funds in a bank deposit account yielding a return of 7% per annum, net of tax.

You are required to:

- prepare calculations showing which projects Raiders Ltd should undertake if capital for immediate investment is limited to £500 000, but is expected to be available without limit at a cost of 10% per annum thereafter; (5 marks)
- provide a mathematical programming formulation to assist the directors of Raiders Ltd in choosing investment projects if capital available immediately is limited to £500 000, capital available after one year is limited to £300 000, and capital is available thereafter without limit at a cost of 10% per annum; (8 marks)
- outline the limitations of the formulation you have provided in (b); (6 marks)
- comment briefly on the view that in practice capital is rarely limited absolutely, provided that the borrower is willing to pay a sufficiently high price, and in consequence a technique for selecting investment projects which assumes that capital is limited absolutely, is of no use. (6 marks)

(Total 25 marks)

ICAEW Financial Management

The directors of Anhang plc are considering how best to invest in four projects, details of which are given below.

Learning Note 25.2 (Question 5)

	Project I	Project II	Project III	Project IV
Net present value (£000)	+80	+40	+120	+110
Beta factor of project	1.0	1.0	0.8	1.2
Initial payment (000)	50	40	90	55

The net present values of the projects have been calculated using specific, risk-adjusted discount rates. The directors choice is complicated because Anhang plc has only £90 000 currently available for investment in new projects. Each project must start on the same date and cannot be deferred. Acceptance of any one project would not affect acceptance of any other and all projects are divisible. The directors at a recent board meeting were unable to agree upon how best to invest the £90 000. A summary of the views expressed at the meeting follows:

- Wendling argued that as the presumed objective of the company was to maximize shareholder wealth, project III should be undertaken as this project produced the highest net present value.

- (ii) Ramm argued that as funds were in short supply investment should be concentrated in those projects with the lowest initial outlay, that is in projects I and II.
- (iii) Ritter suggested that project III should be accepted on the grounds of risk reduction. Project III has the lowest beta, and by its acceptance the risk of the company (the company's present beta is 1.0) would be reduced. Ritter also cautioned against acceptance of project IV as it was the most risky project; he pointed out that its high net present value was, in part, a reward for its higher level of associated risk.
- (iv) Punto argued against accepting project III, stating that if the project were discounted at the company's cost of capital, its net present value would be greatly reduced.

Requirements:

- (a) Write a report to the directors of Anhang plc advising them how best to invest the £90 000, assuming the restriction on capital to apply for one year only. Your report should address the issues raised by each of the *four* directors. (17 marks)
- (b) Explain why the criteria you have used in (a) above to determine the best allocation of capital may be inappropriate if funds are rationed for a period longer than one year. (4 marks)
- (c) Describe the procedures available to a company for the selection of projects when capital is rationed in more than one period. (4 marks)

(Total 25 marks)

ICAEW Financial Management

Solution to Learning Note 4.1 (Question 3)

(a)	Contract accounts						
	1	2	3		1	2	3
	(£)	(£)	(£)		(£)	(£)	(£)
Plant on site	16 000	12 000	8 000	Materials stock c/f	3 000	3 000	1 500
Materials	44 000	41 000	15 000	Cost of work not			
Wages	80 000	74 500	12 000	certified c/f	4 000	6 000	9 000
General expenses	3 000	1 800	700	Plant on site c/f	12 000	10 000	7 500
Central overheads	1 600	1 490	240	Cost of work certified			
Accrued				(balance)	136 300	112 390	18 540
expenses c/f	700	600	600				
Provision for							
faulty work c/f	10 000						
	<u>155 300</u>	<u>131 390</u>	<u>36 540</u>		<u>155 300</u>	<u>131 390</u>	<u>36 540</u>
Cost of work				Attributable sales			
certified b/f	136 300	112 390	18 540	revenue	145 433	110 000	18 540
Profit taken				Loss taken		2 390	
this period	9 133						
	<u>145 433</u>	<u>112 390</u>	<u>18 540</u>		<u>145 433</u>	<u>112 390</u>	<u>18 540</u>
Cost of work not				Accrued			
certified b/f	4 000	6 000	9 000	expenses b/f	700	600	600
Material stock b/f	3 000	3 000	1 500	Provision for			
Plant on site b/f	12 000	10 000	7 500	faulty work b/f	10 000		

Profit calculations

Contract 1: $\frac{2}{3} \times £13\,700$ profit.

Contract 2: The loss to date (£112 390 – £110 000) is written off.

Contract 3: The contract is less than one-third complete. Therefore no profit is taken for the period.

(b) *Balance sheet (extracts)*

	(£)	(£)
Plant on site ^a (£12 000 + £10 000 + £7500)		29 500
Raw material stock (£3000 + £3000 + £1500)		7 500
Cost of work completed to date ^b (£140 300 + £118 390 + £27 540)	286 230	
Add profit taken (£9133 – £2390)	<u>6 743</u>	
	292 973	
Less progress payments received ^c (£120 000 + £88 000 + £16 000)	<u>224 000</u>	<u>68 973</u>
Accrued expenses (£10 000 + £1900)		<u>11 900</u>

Notes

^a Closing value of plant on site is calculated as follows:

Contract 1 = £16 000 – (£16 000/4)

Contract 2 = £12 000 – (£4000 annual depreciation for 6 months)

Contract 3 = £ 8000 – (£2000 annual depreciation for 3 months)

^b Note that completed work to date consists of the cost of uncertified work plus the cost of the certified work.

^c It is assumed that cash has been received in respect of the invoiced value of work certified.

(a) (i) *Orders 488 and 517:*

Both orders span two accounting years and are of significant value. They should therefore be treated as long-term contracts.

Orders 518 and 519:

Both orders are of small value and short duration even though they span two accounting years. Because of the short duration it is inappropriate to apportion the profits between the accounting periods. Profit should be recognized when the orders are completed. However, if a loss is foreseen it should be charged to the first accounting period.

(ii)

Works order number	488	517	518	519	Total
	(£000)	(£000)	(£000)	(£000)	
Valuation of work done	350	30	15	5	
Total sales value	450	135	18	9	
Direct costs incurred to date	(191)	(17)	(9)	(4)	
Overhead at 40% on labour	(42)	(4)	(2)	(0.8)	
Total costs to date	(233)	(21)	(11)	(4.8)	
Costs to complete, inclusive of overheads	(66)	(99)	—	—	
Total costs to complete	(299)	(120)			
Estimated contract profit	151	15			
Recognized profit	117(1)	nil (2)	nil (3)	nil (3)	117
Total costs incurred to date	233	21	11	4.8	
Less: included in cost of sales	233	—	—	—	
WIP	nil	21	11	4.8	36.8

**Solution to
Learning Note 4.1
(Question 4)**

Notes:

- (1) $\frac{\text{Value of work certified (£350)}}{\text{Contract price (£450)}} \times \text{Estimated profit from the contract (£151)}.$
- (2) No profit is taken since the contract is at an early stage of completion.
- (3) Profit to be recognized on completion.
- (iii) Attributing overheads to products on the basis of direct labour is justified if the majority of overhead resources consumed by products is caused by direct labour. In today's environment direct labour has diminished in importance and it is claimed that many overhead costs are caused by factors other than direct labour (such as the number of deliveries, etc.). Using direct labour means that overheads allocated to orders will be reduced by reducing a diminishing labour content. However, the end result will be a minor reduction in direct labour costs. Those overheads that are not caused by direct labour will remain unchanged. Inaccurate product costs will also be reported.
- (b) See the section on job and process costing in Chapter 2 and the introduction in Chapter 5 for the answer to this question.

Solution to Learning Note 25.2 (Question 4)

- (a) If funds are restricted for immediate investment only, the projects should be ranked by the profitability index. The calculations are as follows:

Project	Present value (NPV + investment cost) (£000)	Investment cost (£000)	Profitability index	Ranking
A	557.0	400	1.39	3
B	450.0	300	1.50	2
C	373.5	300	1.24	4
D	159.5	0		1

Therefore the company should undertake projects D, B and half of A. The total NPV (£000) resulting from this strategy is $159.5 + 150 + (0.5 \times 157) = £388\ 000$.

- (b) Let a , b , c and d represent the proportion of projects A, B, C and D accepted, and X represent surplus funds placed on deposit at t_0 at 7% in £000. Then

$$\begin{aligned} \text{NPV of £1000 invested in } X &= \frac{£1070}{1 + 0.10} - 1000 \\ &= -£27.27 \end{aligned}$$

Linear programming model

Maximize $157a + 150b + 73.5c + 159.5d - 0.027X^a$ subject to:
 $400a + 300b + 300c + X \leq 500$ (t_0 constraint in £000)
 $200b + 300d \leq 300 + 50a + 150c + 1.07X$ (t_1 constraint in £000)
 $a, b, c, d, X \geq 0$
 $a, b, c, d \leq 1$

Note

^a Note that the model is expressed in £000. Therefore $-£27.27$ expressed in £000 is $-£0.027$. Also note that surplus funds are placed on deposit at t_0 only. After t_1 , capital is available without limit. Consequently it is assumed at t_1 that it is unnecessary to maintain funds for future periods by placing funds on deposit to yield a negative NPV. In the above model it is assumed that capital constraints can be eased by project-generated cash flows. If this is not possible and capital constraints are absolute, the formulation is:

$$\begin{aligned} \text{Maximize } & 157a + 150b + 73.5c + 159.5d - 0.027X \text{ subject to:} \\ & 400a + 300b + 300c + X \leq 500 \\ & 200b + 300d \leq 300 + 1.07X \\ & a, b, c, d, X \geq 0 \\ & a, b, c, d \leq 1 \end{aligned}$$

- (c) The limitations are as follows:
- (i) Divisibility of projects may not be realistic, and integer programming may have to be used.
 - (ii) Constraints are unlikely to be completely fixed and precise as implied in the mathematical models.
 - (iii) Not all the relevant information can be quantified. For example, market constraints might exist which cannot be quantified.
 - (iv) All information for the model may not be available. For example, it may not be possible precisely to specify the constraints of future periods.
 - (v) All the relationships contained within the formulation may not be linear.
 - (vi) All the potential investment opportunities may not be identified and included in the analysis.
 - (vii) The linear programming formulation assumes that all the project's cash flows are certain and therefore it cannot incorporate uncertainty. The solution produced can only be considered optimal given this restrictive assumption.
 - (viii) All investments may not be independent of each other. There may be some unspecified interdependencies.
- (d) The answer should distinguish between hard capital rationing (externally imposed) and soft capital rationing (internally imposed). It can be argued with hard capital rationing that if a firm has investment opportunities it will eventually be able to raise the finance even though it might have to pay a high price. If short-term market imperfections exist through lack of information then capital rationing might exist in the short term, but it has no long-term significance. An alternative view is that gaps in the institutional framework for providing finance may result in companies having no access to appropriate financial institutions and therefore no access to investment funds at certain stages in their development. This might occur with small expanding firms. Consequently hard capital rationing might exist in practice.

Soft capital rationing might exist where a firm is obtaining adequate returns and has no wish to expand. Also management expertise might be limited and unable to cope with growth. In addition, some firms may be reluctant to raise additional funds because the shareholders may fear losing control of the business.

- (a) The report should recommend investment of £55 000 in project IV and the remaining £35 000 in project I. This decision is based on the following calculation:

Project	NPV (£000)	Initial investment	Profitability index	Ranking
I	80	50	1.6	2
II	40	40	1.0	4
III	120	90	1.33	3
IV	110	55	2.0	1

The maximum NPV is £166 000, consisting of £110 000 from project IV and £56 000 from project I [i.e. (£35 000 – £50 000) × £80 000]. This recommendation is based on the assumption that the objective is to maximize shareholders' wealth, and this objective will be achieved by maximizing NPV. The NPV decision rule is based on the assumption that the stockmarket values a firm by discounting future dividends at a discount rate which reflects the risk of these dividends. The cash flows from a project will be used eventually to increase dividends, and therefore the value of a firm will increase by the NPV of capital investments provided the mar-

Solution to Learning Note 25.2 (Question 5)

ket is aware of these cash flows and believes that they will occur. In other words, the efficient market hypothesis is assumed to hold in its strong form.

Risk has been incorporated into the analysis by discounting the cash flows at a risk-adjusted discount rate using the capital asset pricing model (CAPM). The CAPM assumes that all shareholders in the company hold well-diversified portfolios and have eliminated unsystematic risk. If the shareholders do not hold well-diversified portfolios, the adjusted discount rate will not reflect the total risk which the shareholders are exposed to from investing in projects I–IV.

The report should also include a discussion of the issues raised by four directors. Wendling favours investment in project III because it yields the largest NPV. However, Wendling has failed to take into account the high cost of the investment and the fact that projects I and II yield larger NPVs per £1 of investment. In other words, it is necessary to rank projects by the profitability index when the company is faced with a capital rationing situation.

Ramm appears to favour projects with low outlays, so that the number of projects accepted can be maximized. He is also focusing on whole projects and ignoring the fact that all projects are divisible.

Ritter favours risk reduction, and therefore supports acceptance of the project with the lowest beta so as to reduce the company's overall beta. However, he ignores the fact that shareholders can obtain the risk reduction themselves by combining securities with different betas in their portfolio. Consequently there is no point in the company diversifying in this manner. Presumably, in terms of risk, existing shareholders have found the existing beta of the company to be acceptable. Those investors who favour risk reduction will already have sold their shares and invested their funds in low-beta securities. With regard to Ritter's objections to project IV, it should be noted that risk has already been incorporated into the analysis by using risk-adjusted discount rates. The NPV of project IV is high because it is an attractive project even after taking risk into account.

Punto is against project III because the NPV will be much lower when discounted at the company's cost of capital. Punto ignores the fact that project III has the lowest risk, with a beta value of 0.8, whereas the company's present beta is 1.0. The overall company cost of capital will be calculated using a beta of 1.0 (this represents the average of the betas for the firm's existing projects). The cash flows from a project should be discounted at a rate which reflects the risk of a project. The greater the risk the greater the discount rate. It is therefore incorrect to use a discount rate calculated from a beta of 1.0 to discount a project which has a beta of 0.8.

- (b) If funds are rationed for a period of longer than one year then a project's profitability index for later years (e.g. NPV/year 2 investment outlay) is likely to differ from the profitability index for year 1. Consequently project rankings will vary from year to year and it will not be possible to use the profitability index to make the optimal decision. The profitability index can only be used when the investment requirements for different projects are always in the same proportion each year. For example, in year 1 the investment in project II is 80% of the investment in project I. If the investment in year 2 for project I is £20 000 then the ratio will be maintained if the outlay for year 2 is £16 000.
- (c) The answer to this question should include an explanation of how linear programming can be used to maximize NPV when capital is rationed for more than one period. For a detailed explanation see 'The use of linear programming in capital budgeting' in Learning note 25.2.