Answers

1 The answer should be presented as a briefing note.

The standard financial appraisal is supplemented by a sensitivity analysis. A discussion of the principal uncertainties and recommendation of a further process of evaluation to assess the volatility of the project is presented.

(i) Estimation of the net present value (NPV) of the project

Estimated Project NPV (all values quoted in $million):

30-year annuity factor, growth rate 4% and discount rate 10%

$$A_n = \left[\frac{1-\left(\frac{1+g}{1+i}\right)^n}{i-g}\right](1+g) = \left[\frac{1-\left(\frac{1{\cdot}04}{1{\cdot}1}\right)^{30}}{0{\cdot}1-0{\cdot}04}\right]1{\cdot}04 = 14{\cdot}11$$

Year/Type	Cash Flows ($m)	DF (10%)	Present value ($m)
2012 Construction	(300)	$1{\cdot}1^{-1}$	(272·7)
2013 Construction	(600)	$1{\cdot}1^{-2}$	(495·9)
2014 Construction	(100)	$1{\cdot}1^{-3}$	(75·1)
2015–2044 Annual operating surplus	100	$14{\cdot}11 \times 1{\cdot}1^{-3} = 10{\cdot}601$	1060·1
2044 Decommissioning	600	$1{\cdot}04^{33} \times 1{\cdot}1^{-33} = 0{\cdot}1571$	(94·3)
NPV			122·1

On the basis of the above, the net present value of the project as at 1 January 2012 is $122·1 million which indicates that the project will add value to the business.

(ii) An analysis of the principal uncertainties associated with this project

Uncertainty in capital investment projects can be categorised as misestimation of:

(i) the timing and the level of capital expenditure over the investment phase of the project;
(ii) the operating surpluses from the project and their timing;
(iii) the timing and amount of closure costs; and
(iv) the discount rate.

Capital Expenditure: with large scale investment projects uncertainty will attach to the timing and costs of the capital construction. Where building is undertaken by external contractors there may be legal issues in forming a complete contract and in monitoring performance against it. In addition to engineering difficulties causing delay in construction, problems can also occur on the costs of labour, raw material supplies and other costs.

Operating Surplus: This will depend upon a number of capacity estimates (theoretical and actual), market costs for labour, materials and operating overheads. In addition, the supply of electricity is subject to national demand and unit prices will depend upon alternative capacity, alternative energy supplies (fossil and renewable) and whether they can contribute to marginal or to base load.

Closure Costs: These can be high in this industry although their remoteness diminishes their significance in present value terms. The timing and estimates of the magnitude of such costs will have a small impact upon the viability of the project as a capital investment.

The discount rate: This can be difficult to estimate for a project of this scale. In practice such rates are taken from a mixture of models and sources, all of which have uncertainties attached. The gearing of the business will determine the importance of uncertainty attaching to each capital source. There is also likely to be significant social externalities with a project of this type affecting its valuation and hence the discount rate which should be applied. Such social externalities range from the reduction in dependence upon fossil fuels and associated carbon emissions, the relatively low pollution costs compared with fossil fuels, and the stability and security of supply.

In addition there may be a range of **real options** attaching to a project of this type: (i) the option to delay, (ii) the option to expand or contract capacity, (iii) the option to withdraw early or extend the operating life of the project. Each of these will add value to the firm by helping to eliminate the downside exposure and focusing the expected value calculation on the upside of the possible distribution of outcomes.

(iii) Project sensitivity

In order for the net present value to reduce to nil, the NPV must reduce by $122·1m.

Construction Cost
Cost increase per $100m x $(3 \times 1{\cdot}1^{-1} + 6 \times 1{\cdot}1^{-2} + 1 \times 1{\cdot}1^{-3}) = \$122{\cdot}1m$
Cost increase per $100m x $(3 \times 0{\cdot}9091 + 6 \times 0{\cdot}8264 + 1 \times 0{\cdot}7513) = \$122{\cdot}1m$

Cost increase per $100m = $122·1m/8·4370 = $14·47m
Year 1 cost will increase to $343·41m ($300m + $14·47m x 3), Year 2 cost will increase to $686·82m and year 3 cost will increase to $114·47m. An increase of 14·47% in each year before NPV becomes zero.

Annual Operating Surplus
$122·1m/10·601 = $11·52m
Surplus needs to reduce to $88·48m (11·52%) before NPV becomes zero.

Decommissioning Costs
$122·1m/0·1571 = $777·2m
Decommissioning costs need to increase by $777·2m (129·5%) in 1 January 2012 value before NPV becomes zero.

The annual operating surplus is the most sensitive to changes.

(iv) Volatility Assessment

The assessment of the volatility (or standard deviation) of the net present value of a project entails the simulation of the financial model using estimates of the distributions of the key input parameters and an assessment of the correlations between variables. Some of these variables are normally distributed but some (such as the decommissioning cost) are assumed to have limit values and a most likely value. Given the shape of the input distributions, simulation employs random numbers to select specimen value for each variable in order to estimate a 'trial value' for the project NPV. This is repeated a large number of times until a distribution of net present values emerge. By the central limit theorem the resulting distribution will approximate normality and from which project volatility can be estimated.

In its simplest form, Monte Carlo simulation assumes that the input variables are uncorrelated. However, more sophisticated modelling can incorporate estimates of the correlation between variables. Other refinements such as the Latin Hypercube technique can reduce the likelihood of spurious results occurring through chance in the random number generation process. The output from a simulation will give the expected net present value for the project and a range of other statistics including the standard deviation of the output distribution. In addition, the model can rank order the significance of each variable in determining the project net present value.

2 The answer should be presented in a report format.

Due to the size of the acquisition it is necessary to establish the potential group value on the presupposition that shareholder value is not reduced in AggroChem. This will give the maximum premium that should be paid.

(i) Using the free cash flow valuation model for AggroChem (which is wholly financed by equity) we can estimate the market value:

Estimated market value =
Free cash flows (FCF) x (1 + growth rate)/(cost of capital (Ke) – growth rate (g))

Note: Since AggroChem is financed wholly by equity, its cost of capital is equal to its cost of equity.

Free cash flow $'000) = NOPAT – net reinvestment = 580 – 180 = 400

Assume: g = retention rate x cost of capital (Ke)

Taking the net reinvestment as a ratio of NOPAT we obtain the retention ratio (b):

$$b = \frac{180}{580} = 31{\cdot}03\%$$

Ke = 5% + 1·26 x 6% = 12·56%

g = 0·3103 x 0·1256 = 0·0390

Market value = $400,000 (1·0390)/(0·1256 – 0·0390) = $4,799,000

This modelling method assumes that the free cash flow model fairly represents the fair value of the business, that the company is a going concern, that the discount rate has a flat term structure, and that future growth is constant and the growth rate is based on the assumption that retained earnings can be invested at the cost of capital. In practice one or more of these assumptions may be violated.

(ii) Using the BSOP model in company valuation rests upon the idea that equity is a call option, written by the lenders, on the underlying assets of the business. If the value of the company declines substantially then the shareholders can simply walk away, losing the maximum of their investment. On the other hand, the upside potential is unlimited once the interest on debt has been paid.

BSOP model can be helpful in circumstances where the conventional methods of valuation do not reflect the risks fully or where they can not be used. Given the gearing of the two companies, the low levels of trading in each company's equity, and their future growth potential, including its volatility, it is appropriate to handle the valuation by focusing upon the real option value attributable to the post-acquisition business.

There are five variables which are input into the BSOP model to determine the value of the option. Proxies need to be established for each variable when using the BSOP model to value a company. The five variables are: the value of the underlying asset, the exercise price, the time to expiry, the volatility of the underlying asset value and the risk free rate of return.

For the exercise price, the debt of the company is taken. In its simplest form, the assumption is that the borrowing is in the form of zero coupon debt, i.e., a discount bond. In practice such debt is not used as a primary source of company finance and so we calculate the value of an equivalent bond with the same yield and term to maturity as the company's existing debt. The exercise price in valuing the business as a call option is the value of the outstanding debt calculated as the present value of a zero coupon bond offering the same yield as the current debt.

The proxy for the value of the underlying asset is the fair value of both the companies' assets less current liabilities on the basis that if the company is broken up and sold, then that is what the assets would be worth to the long-term debt holders and the equity holders.

The time to expiry is the period of time before the debt is due for redemption. The owners of the company have that time before the option needs to be exercised, that is when the debt holders need to be repaid. The proxy for the volatility of the underlying asset is the volatility of the business' assets. The risk-free rate is usually the rate on a riskless investment such as a short-term government bond.

(iii) The exercise price is determined by an equivalent zero coupon bond. LeverChem's debt is a variable rate loan; the yield is the current rate of 8%. The equivalent zero coupon debt with a term to maturity of five years is as follows:

$\$3 \text{ million} \times 1{\cdot}08^{-5} = \$2{\cdot}04175 \text{ million}$

To value the equity of the combined business as a call option we take the following as the inputs into the model:

The underlying assets of the business = \$8·6 million assuming fair values

The exercise price = \$2·04175 million

Risk free rate = 5%

Time to exercise = 5 years

Volatility = 0·35

Applying the BSOP Model:

$d_1 = [\ln(8{\cdot}6/2{\cdot}04175) + (0{\cdot}05 + 0{\cdot}5 \times 0{\cdot}35^2) \times 5]/(0{\cdot}35 \times 5^{1/2})$
$d_1 = 2{\cdot}548$

$d_2 = 2{\cdot}548 - (0{\cdot}35 \times 5^{1/2})$
$d_2 = 1{\cdot}765$

$N(d_1) = 0{\cdot}9946$

$N(d_2) = 0{\cdot}9612$

Call value = $\$8{\cdot}6\text{m} \times 0{\cdot}9946 - \$2{\cdot}04175 \times 0{\cdot}9612 \times e^{-0{\cdot}05 \times 5} = 8{\cdot}55356 - 1{\cdot}52842 = 7{\cdot}02514$

The value of the call on the combined firm's assets is approximately \$7·025 million.

Deducting AggroChem's current equity

\$7·025m – \$4·799m = \$2·226m

This suggests that the maximum price which should be paid to the shareholders in LeverChem is \$2·226m.

Market value of LeverChem = $\$1{,}200{,}000 \times 1{\cdot}33^1/_3 = 1{,}600{,}000$

Maximum premium payable \$626,000 or just over 39%.

In part (iii), the risk free rate could be taken as $\ln(1{\cdot}05) = 0{\cdot}0488$ or 4.88%. If this rate is used, the answer changes as follows:

$N(d_1) = 0{\cdot}9945$

$N(d_2) = 0{\cdot}9605$

Call value = \$7·017 million

Maximum price = \$2·218 million

Premium = \$618,000 or 38·6%.

(iv) Although the BSOP model is very effective in valuing continuously traded securities in active markets, its validity is more questionable where the basic assumptions supporting the model do not hold. It is assumed that the value of the assets of the business change randomly around a rising trend and are thus log-normally distributed. It is also assumed that they are traded in frictionless markets and the holding can be continuously adjusted. Finally, the model is only appropriate for European style options. Given these assumptions, the modelling can only be expected to give an indicative rather than a definitive value, but in the absence of any alternative is a useful adjunct to commercial judgement.

3 **(a)** In order to estimate the returns an annual cash account should be created showing the cash flow receivable from the pool of assets and the cash payments against the various liabilities created by the securitisation process. In this securitisation a degree of leverage has been introduced by the swap giving a return of 19·05% to the holders of the subordinate certificates but carrying a high degree of risk.

Cash flow receivable	**$million**	**Cash flow payable**		**$million**
$200 million x 10·5%	21·00	A-rated bonds	LIBOR	2·13
less service charge	0·24	$152 million at 1·4%		
		B-rated bonds		
		$19 million at 11%		2·09
		SWAP		
		Receive LIBOR	–LIBOR	
		Pay 8·5% on $152m		12·92
	20·76			17·14
		Balance to the subordinated certificates		3·62

The return to the holders of the certificates is $3·62 million on $19 million or 19·05%. A reduction of 1% in the cash flow receivable brings about a fall in the annual receivable to $20·79 million, reducing the balance available for the subordinated certificates to $3·41 million. A reduction of 1% in the cash flow receivable, results in a fall of 5·80% ([3·62 – 3·41]/3·62) in revenue of the subordinated certificates.

(b) A securitisation of this type is a common method of refinancing in a large business. After the securitisation of mortgages, car loan securitisation is the most important source of refinancing in the US and in Europe. Structured finance arrangements such as this are also used in a variety of other industries from banking to entertainment. The process of credit enhancement is the process whereby a relatively high risk cash flow (car loans) can be converted into a range of collateralised loan obligations satisfying the varying risk appetites of different investors. In the securitisation process a rating agency would normally advise on the structure of the liabilities created such that the AAA tranche will attract investors such as banks and other financial institutions who demand a low level of risk exposure. This reduction in risk for the senior and intermediate level notes is balanced by a significant transfer of risk to the subordinated certificate holders. Tranching the issue rather than creating a single issue of an asset backed security is the most important mechanism for credit enhancement.

Other approaches can entail insuring the risk of the issue through the use of credit default swaps or by transferring a greater asset pool than is securitised (over collateralisation).

(c) There are a number of risks inherent in the securitisation process faced by the investor:

Correlation risk: it is often assumed that defaults on the asset side of the securitisation process are uncorrelated. However, if a degree of positive correlation is present (such as defaulting car loans and repossessions) being positively associated with rising unemployment) then this can create higher than anticipated volatility in the receivables.

Timing and liquidity risk: the question only refers to average returns which presumably consist of a mixture of repayments, interest and possibly the anticipated recovery from repossessions. Modelling the cash flow 'waterfall' is a difficult issue where the timing of the cash receipts is crucial in fulfilling the commitments to the various tranches.

Default and collateral risk: the success of the securitisation will be dependent upon the assessment of the quality of the loans made to car purchasers. Dealers selling cars are responsible for the primary credit assessment and tight controls are necessary for ensuring that the loans are properly negotiated. Risk arises both in terms of default but also in the value of the vehicle on repossession.

From GoSlo's perspective the risks attaching to the process are more straightforward and to a certain extent depend on the motivation for the securitisation. If it is simply to refinance activity then the risk is that the issues will be undersubscribed. If it is also to remove the assets from the balance sheet then much will depend on whether loans of this type can be transferred to a special purpose vehicle such that full legal ownership passes. **(Note: this paragraph is not required to answer part (c), but has been included for tutorial purposes.)**

4 Corporate disposal of this type raises a number of issues. In deciding whether disposal is the appropriate course of action MandM should follow, the company needs to clarify its motives for disposal. The question suggests that there is no business case for retaining the LunarMint operation. However, the concept of what is core business and what is not, is a matter of judgement – and where that business is profitable, senior management need to be very careful in making that judgement. The question arises why did they diversify into this rather odd line of business for a money mint manufacturing company in the first place? Was it because printing money was not generating the returns required for the level of risk being carried?

The steps involved in the procedure for preparing a business such as this for sale are as follows:

1. A decision would need to be made about the nature of the assets being transferred and the process for resolving whether and how any joint assets might be sold. Fair value for all of the assets to be disposed of should then be established on the basis of an orderly sale as a going concern.
2. Checking the status of all intellectual property, that all patents are established and where necessary further valuable corporate knowledge, brand symbols and proprietary processes should be patented or protected by copyright.

3. Identification and valuation of the LunarMint contribution to the business. This may involve improving the business by a thorough operating and business process review, implementing any changes that might improve reported profitability and removing any impediments to a sale. It may be that the whole business is to be sold as a going concern or that only elements of the business will be disposed of. The valuation must assess the impact of the disposal upon the shareholder value in MandM both before and after a potential sale to identify a threshold value which will lead to no loss of shareholder value. Where the impact upon the firm's exposure to systematic risk is significant the valuation process will be recursive entailing sophisticated modelling of the potential loss of cash-flow to the group and the impact of the uncoupling on the firm's asset beta.
4. Any regulatory issues need to be clarified. Would sale to any of the potential purchasers conflict with the public interest and present problems gaining approval for the acquisition?
5. Potential buyers will need to be sought through open tender or through an intermediary. Depending upon the nature of the assets being sold a single bidder may be sought or preparations made for an auction of the business as a going concern. Members of the LunarMint supply chain and distribution channels may be interested, as may be competitors in the confectionary business. High levels of discretion are required in the search process to protect the value of the business from adverse competitive action. An interested and dominant competitor may open a price war in order to force down prices and hence the value of LunarMint prior to a bid.
6. Once a potential buyer has been found, access should be given so that they can conduct their own due diligence. Up-to-date accounts should be made available and all legal documentation relating to assets to be transferred made available.
7. The company should undertake its own due diligence to check the ability of the potential purchaser to complete a transaction of this size. Before proceeding it would be necessary to establish how the purchaser intends to finance the purchase, the timescale involved in their raising the necessary finance and any other issues that may impede a clean sale.
8. If not already involved the firm's legal team will need to assess any contractual issues on sale, the transfer of employment rights, the transfer of intellectual property and any residual rights and responsibilities to MandM. Normally, a clean separation should be sought unless an agreement is required concerning the use of joint assets.
9. In the light of the above and (3) in particular a sale price will be negotiated which will increase the shareholder value of LunarMint. The negotiation process should be conducted by professional negotiators who have been thoroughly briefed on the terms of the sale, the conditions attached and all of the legal requirements. The consideration for the sale, the deeds for the assignment of assets and terms for the transfer of staff and their accrued pension rights will also all be subject to agreement.
10. Once the sale has been agreed in principle it is important to address all of the employment issues which will include communicating with staff the reasons for the sale, the protection of their rights on transfer, the handling of any incentive payments including share options and the transfer of their pension rights. This step may involve discussion with unions and other employee representatives.
11. Given the size of the business being sold shareholder agreement may also be required and if so the process should be put in place to gain their approval.
12. Finally the contracts for sale and the completion documents can be exchanged and the sale completed.

5 (a) Determination of the currency transfers required

There are a number of ways this problem can be handled. Two methods are shown here, the first uses a transactions matrix and the second is a route minimisation algorithm.

Given that all balances are to be cleared through the European office, proceed as follows.

Convert all indebtedness between parties to Euros using the specified exchange rates:

	million	€ million
US$	6·40	4·67
S$	16·00	7·75
US$	5·40	3·94
Euros	8·20	8·20
US$	5·00	3·65
Rm	25·00	5·01
£	2·20	2·34
S$	4·00	1·94
Rm	8·30	1·66

Transactions Matrix

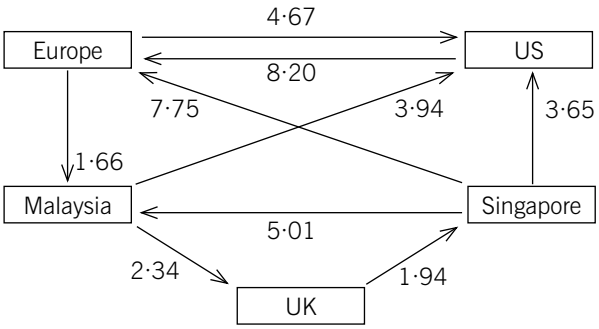
		Europe	US	Owed to Malaysia	Singapore	UK	Owed by
	Europe		4·67	1·66			6·33
	US	8·20					8·20
Owed by	Malaysia		3·94			2·34	6·28
	Singapore	7·75	3·65	5·01			16·41
	UK				1·94		1·94
	Owed to	15·95	12·26	6·67	1·94	2·34	
	Owed by	6·33	8·20	6·28	16·41	1·94	
	Net	9·62	4·06	0·39	–14·47	0·40	

(All amounts are in € million)

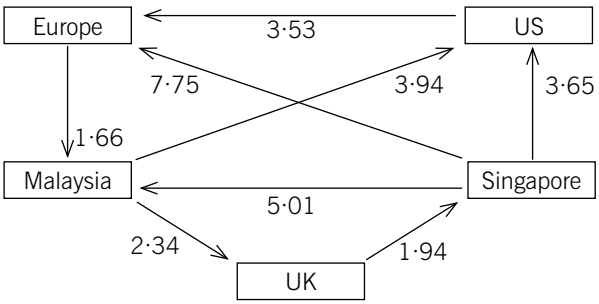
Multidrop (Europe) pays the US, UK and Malaysian business €4·06 million, €0·40 million, and €0·39 million respectively, and receives from Singapore €14·47 million. The net income is €9·62 million to Multidrop (Europe).

Route Minimisation Algorithm

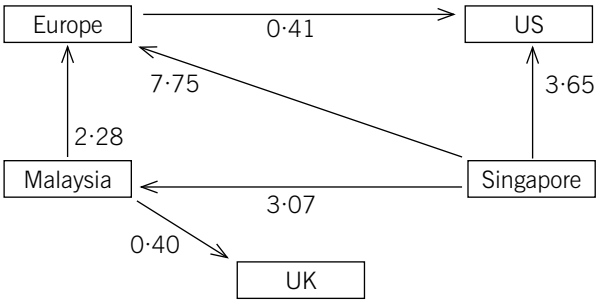
Step 1: Network of Indebtness



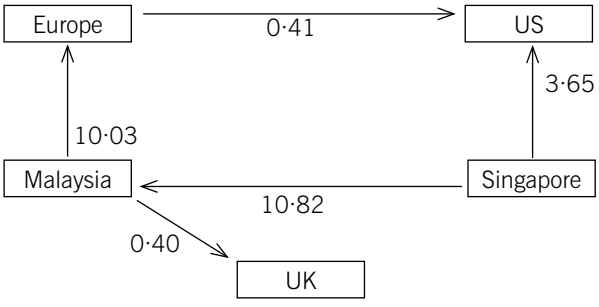
Step 2: Resolve any bilaterals



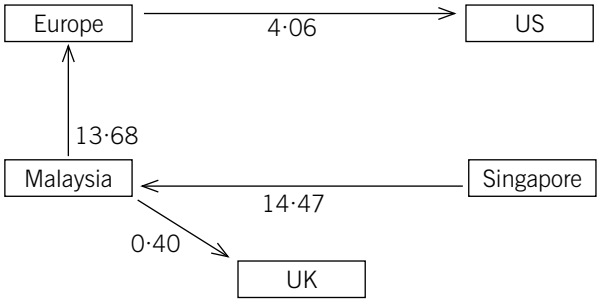
Step 3: Identify and clear circuits



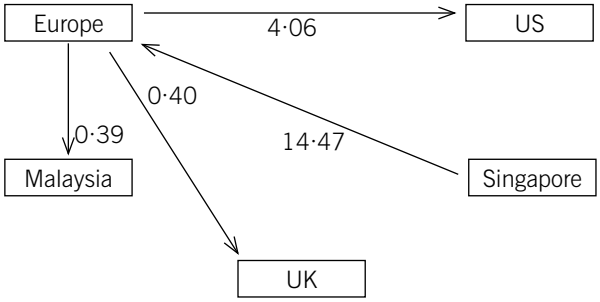
Step 4: Identify and clear cross indebtedness



And also:



Step 5: Finally resolve all indebtedness in favour of Europe



(All amounts are in € million)

(b) Netting Arrangements with the global business and trading partners

Netting is a mechanism whereby mutual indebtedness between group members or between group members and other parties can be reduced. The advantages of such an arrangement is that the number of currency transactions can be minimised, saving transaction costs and focusing the transaction risk onto a smaller set of transactions that can be more effectively hedged. It may also be the case, if exchange controls are in place limiting currency flows across borders, that balances can be offset, minimising overall exposure. Where group transactions occur with other companies the benefit of netting is that the exposure is limited to the net amount reducing hedging costs and counterparty risk.

The disadvantages: some jurisdictions do not allow netting arrangements, and there may be taxation and other cross border issues to resolve. It also relies upon all liabilities being accepted – and this is particularly important where external parties are involved. There will be costs in establishing the netting agreement and where third parties are involved this may lead to re-invoicing or, in some cases, re-contracting.

			Marks	
1	**(i)**	**NPV calculation**		
		Calculation of annuity factor with growth	2	
		Calculation of PV of construction costs	2	
		Calculation of PV of income	2	
		Calculation of PV of decommissioning costs	3	
		NPV and conclusion	2	
				11
	(ii)	**Principal uncertainties**		
		Uncertainty associated with CAPEX	2	
		Uncertainty associated with operating surplus	2	
		Uncertainty associated with decommissioning costs	2	
		Uncertainty associated with the discount rate	2	
		Uncertainty associated with real options	2	
		(Credit will be given for alternative, relevant points)	Max	7
	(iii)	Sensitivity to construction costs	3	
		Sensitivity to annual operating surplus	1	
		Sensitivity to decommissioning cost	1	
		Conclusion	1	
				6
	(iv)	**Volatility assessment**		
		Role of simulation	1–2	
		Process of simulation and its limitations	1–2	
		Outputs (distribution and sensitivities)	1–2	
		(Credit will be given for alternative, relevant points)	Max	4
			Total	**28**

			Marks	
2	**(i)**	Annual free cash flow	1	
		Retention rate	1	
		Cost of equity and growth rate	2	
		Calculation of market value	2	
		Assumptions (1 mark per point, max 3)	3	
				9
	(ii)	Explanation of when it is appropriate to use BSOP to value a company	1–2	
		Explanation of the proxy for the exercise price, the PV of a zero coupon bond	1–2	
		Explanation of the underlying assets	1–2	
		Explanation of the other inputs for the BSOP model	1–2	
			Max	5
	(iii)	Calculation of the PV of the zero coupon bond	2	
		Calculation of $N(d_1)$	3	
		Calculation of $N(d_2)$	1	
		Calculation of call value/value of company	1	
		Maximum price	1	
		Maximum premium	1	
				9
	(iv)	Introductory explanation why BSOP may be limited in determining the value of a company	1–2	
		Explanation of the assumptions made for BSOP	2–4	
		Conclusion about indicative rather than definitive value	1–2	
			Max	5
		Professional marks		4
			Total	**32**
3	**(a)**	Calculation of expected return from pool (inc service charge and over-collateralisation)	2	
		Impact of swap on A-tranche	2	
		Calculation of annual cash flows payable on interest for tranches A-rated and B-rated	2	
		Estimation of return to subordinated certificates	1	
		Impact of marginal change and calculation of sensitivity	3	
				10
	(b)	Explanation and purpose of securitisation	1–2	
		Methods of credit enhancement:		
		Tranching		
		Ratings agency involvement		
		Over-collateralisation		
		Others	2–3	
			Max	4
	(c)	Correlation risk	2–3	
		Timing and liquidity risk	1–2	
		Collateral risk	2–3	
		(Credit will be given for alternative, relevant points)	**Max**	6
			Total	**20**

			Marks	
4		Clarification of assets under sale and purpose	1–2	
		Status of IP and extent and remedy of defects in protection	1–2	
		Valuation and note on recursion problem	2–3	
		Identification of regulatory issues	1–2	
		Search for, and resolving issues involving, potential buyers	2–3	
		Due diligence: Both seller and buyer	3–4	
		Contracting and legal issues	1–2	
		Price negotiation	2–3	
		Employment and transfer of rights and pension	2–3	
		Investor agreement	1	
		Contract and completion	1	
		(Credit will be given for alternative, relevant points)	**Max**	**20**
5	**(a)**	**EITHER: Using Transactions Matrix Method**		
		Set principal as European business	1	
		Conversion to Euros	3	
		Initial amounts owed and owing	2	
		Totals owed and owing	2	
		Net amounts owed	2	
		Conclusion: Payments and receipts to Multidrop (Europe)	2	
				12
		OR: Using Route Minimisation Algorithm Method		
		Set principal as European business	1	
		Conversion to Euros	3	
		Step 1: Network of Indebtness	2	
		Steps 2 and 3: Resolve bilaterals and resolve circuits	2	
		Steps 4 and 5: Clear cross Indebtness and resolve in favour of Multidrop (Europe)	2	
		Conclusion: Payments and receipts to Multidrop (Europe)	2	
				12
	(b)	Minimisation of number of transactions	1–2	
		Minimisation of cost of transacting	1–2	
		Avoidance of exchange controls	1–2	
		Minimisation of hedging costs	1–2	
		Limiting exposure to net	1–2	
		Taxation issues	1–2	
		Acceptance of liability	1–2	
		Re-invoicing and re-contracting	1–2	
			Max	8
			Total	**20**