THE INSTITUTE OF ACTUARIES OF AUSTRALIA

INVESTMENT MANAGEMENT **2002 EXAMINATIONS**
EXAM SOLUTIONS **PAPER TWO**

MARKING GUIDE

Overall

The standard difficulty per exam is KU 20%, SJ 40%, CJ 40%. This exam is slightly overweight KU questions, and correspondingly underweight SJ & CJ questions.

Overall, this exam is expected to be in line with other subject papers in respect of difficulty.

Level of Difficulty

PAPER 2

	Topic	Unit	Aims	KU	SJ	CJ	Total
Question 1	Performance measurement	7	14	4	12	4	**20**
Question 2	Investment environment	1	2		9		**9**
Question 3	Alternative assets, valuation	5	11,12e	3	8	9	**20**
Question 4	Property	5	12a			9	**9**
Question 5	Quantitative investing	1, 4	4, 10	4	6	13	**23**
Question 6	Fixed interest, currency	3, 5	9, 11	12	3	4	**19**
TOTAL				**23**	**38**	**39**	**100**

QUESTION 1: AIMS

Coverage: Unit 7
Aim 14: Monitor investment performance

This question seeks to test the students understanding of analyzing fund manager performance, and the tools used to perform such analysis.

QUESTION 1 **(20 marks)**

You are the asset consultant to a large accumulation industry superannuation fund. The fund uses a range of specialist investment managers in each of the major asset classes. The fund has no reserves and crediting rates are declared quarterly in arrears. Monthly calculations are not available.

The board has an investment sub-committee that meets once a quarter to review the portfolio. The latest balanced / growth fund investment performance survey from your firm is always tabled and discussed at these meetings.

(a) The committee is meeting to consider the results for the fund year just ended (31 December 2002). The performance and asset allocation surveys on the following pages are tabled along with the latest fund investment summary. The investment committee has noted that results over the last quarter and the last year have been above median. Draft a letter to the committee commenting on known and unknown sources of over performance, providing approximate calculations where appropriate.

(12 marks)

(b) The committee feels that their strategy over the last three years has been "low risk" and this should be taken into consideration in reviewing their returns. Describe the calculations you would undertake in order to comment on this issue and outline any other issues you feel should be addressed.

(4 marks)

(c) The committee is particularly concerned over the performance of one of the fund's "boutique" Australian equity managers. When the manager was hired, the following investment philosophy was provided.

> ***"Boutique Investment Management: At BIM we believe that long term performance comes from identifying and capturing long term opportunities. We are more interested in tomorrow's leaders than today's leaders and we use our extensive professional experience to identify and invest in these companies."***

The committee has asked you to prepare some tables and charts that they can have on hand when they interview the manager. Describe the tables or charts you would prepare and why you think they would be appropriate for the committee. **(4 marks)**

Summary information Balanced / Growth Investment Performance Survey (Net Tax and Fees); Periods to 31 December 2002					
	3 Month Return	1 Year Return	2 Year Return	3 Year Return	3 Year Standard Deviation
Number of managers included in survey	38	38	37	33	33
Average Manager	-0.2%	6.8%	8.3%	9.5%	5.7%
Median Manager	-0.3%	6.8%	8.1%	9.4%	5.5%
S&P/ASX 200	-2.0%	5.2%	10.5%	10.9%	10.9%
MSCI World ex Aust in $A	-8.6%	2.2%	9.4%	16.6%	13.9%
UBSWA Composite	4.6%	12.1%	5.2%	6.6%	3.9%
UBSWA Bank Bill	1.6%	6.3%	5.6%	5.5%	0.2%
Salomon World (ex Aus) GBI (H)	3.9%	10.1%	5.4%	7.0%	2.7%
S&P/ASX 200 Property	6.9%	17.8%	5.8%	9.7%	11.4%
Mercer Direct Property	2.6%	11.3%	10.5%	10.2%	1.8%
AWOTE	0.6%	5.1%	4.0%	4.1%	1.1%
CPI	0.3%	5.8%	3.8%	3.0%	2.0%

Summary information Balanced / Growth Asset Allocation Survey as at 31 December 2001									
	Aust Shares	Int'l Shares	Listed Property	Direct Property	Aust Fixed Int	Int'l Fixed Int	Indexed Bonds	Cash	Other
	%	%	%	%	%	%	%	%	%
Overall Average Manager	37.8	20.9	6.3	2.7	17.1	4.4	0.9	9.2	0.7
Overall Asset Weighted Average	37.0	21.5	6.0	2.5	16.0	5.3	1.8	8.8	1.1

Balanced / Growth Asset Allocation Survey as at 31 December 2002									
	Aust Shares	Int'l Shares	Listed Property	Direct Property	Aust Fixed Int	Int'l Fixed Int	Indexed Bonds	Cash	Other
Manager & Fund	%	%	%	%	%	%	%	%	%
Overall Average Manager	37.3	22.2	7.3	2.0	17.4	5.0	0.7	7.7	0.5
Overall Asset Weighted Average	36.5	23.2	6.7	2.5	15.8	5.9	1.8	6.5	1.1

Quarterly Investment Update – 31 December 2002

Asset Allocation

The table below shows the asset allocation of the Fund compared to its benchmark over the last 12 months. The fund has continued its policy of directing new cash flows to underweight asset classes.

Sector	Benchmark	Bench mark	Dec-01	Mar-02	Jun-02	Sep-02	Dec-02
Australian Shares	S&P/ASX 200	25%	25.8%	24.9%	25.7%	25.3%	24.7%
Venture Capital	S&P/ASX 200	5%	4.8%	5.0%	4.8%	4.9%	4.9%
International Shares	MSCI World Ex Aus in $A	15%	17.1%	17.8%	16.6%	16.9%	15.7%
Listed Property	S&P/ASX 200 Property	5%	4.8%	4.6%	4.6%	4.5%	4.7%
Direct Property	Mercer Direct Property	15%	13.8%	14.2%	14.4%	14.0%	14.7%
Australian Bonds	UBSWA Composite	25%	23.5%	23.7%	24.3%	24.3%	25.3%
International Bonds	Salamons World GBI	5%	4.5%	4.4%	4.3%	4.7%	4.8%
Cash	UBSWA Bank Bill	5%	5.7%	5.4%	5.3%	5.3%	5.2%
TOTAL		100%	100.0%	100.0%	100.0%	100.0%	100.0%

Performance
The table below shows the quarterly Fund crediting rate over the last 12 months.

Period	Crediting Rate
March 2002 Quarter	3.19%
June 2002 Quarter	2.28%
September 2002 Quarter	1.69%
December 2002 Quarter	0.65%
Year to 31 December 2002	8.01%

QUESTION 1: SOLUTION

Part (a)

Notes to markers

- The student should observe that the asset allocation of the fund is significantly different to the survey median.
- Student should recognise that the average asset allocation in surveys stays fairly stable and should be able to perform an approximate "attribution" identifying the asset allocation value added relative to the average manager.
- Benchmark return for the median manager for the quarter can be estimated by combining December 2002 median asset allocation weights with quarterly index results. Similar calculations can be performed for the Fund. Either September 2002

or December 2002 weights could be used. While the former is more accurate, the latter provides consistency with the median manager calculations.

- Similar calculations can be performed for the full year, this time using either benchmark allocations as at December 2001 or the average of December 2001 and December 2002 for the median and June 2002 for the Fund. The impact on the broad thrust of the comments will not be material.
- The table attached shows sample calculations.
- The student should recognise that while the calculations may not be accurate due to fees, tax, frequency of calculations etc, it is possible to verify that the majority of the out performance difference can be attributed to asset allocation.
- Student should highlight different benchmarks as a potentially significant ongoing contributor to performance differences.
- Comments on other sources of could include:
- Stock selection and interaction (which are effectively combined in the rough attribution analysis)
- Different effective tax rates
- Fund return is a crediting rate, whereas the managers in the survey will have used daily time weighted returns. Crediting rates are usually money weighted.
- Crediting rates typically have expenses deducted etc.

The following table presents a very rough attribution analysis showing that the majority of the outperformance of the median manager comes from differences in the (largely benchmark) asset allocation of the fund.

		3 Month Results			**Annual Results**		
Sector	**Benchmark**	**Index**	**Fund (using Dec 02 AA)**	**Median (using Dec 02 AA)**	**Index**	**Fund (using Dec 01 AA)**	**Median (using Dec 01 AA)**
Australian Shares	S&P/ASX 200	-1.97%	24.7%	37.8%	5.22%	25.8%	38.5%
Venture Capital	S&P/ASX 200	-1.97%	4.9%	0.0%	5.22%	4.8%	0.0%
International Shares	MSCI World Ex Aus in $A	-8.63%	15.7%	22.2%	2.19%	17.1%	20.9%
Listed Property	S&P/ASX 200 Property	6.89%	4.7%	7.3%	17.85%	4.8%	6.3%
Direct Property	Mercer Direct Property	2.56%	14.7%	2.0%	11.30%	13.8%	2.7%
Australian Bonds	UBSWA Composite	4.60%	25.3%	18.1%	12.08%	23.5%	18.0%
International Bonds	Salomons World GBI	3.89%	4.8%	5.0%	10.10%	4.5%	4.4%
Cash	UBSWA Bank Bill	1.64%	5.2%	7.6%	6.27%	5.7%	9.2%
Total expected return (benchmark asset allocations and index returns)			**0.20%**	**-0.96%**		**8.03%**	**7.09%**
Expected outperformance (Fund return less median return)				**1.16%**			**0.94%**
Actual fund returns			**0.65%**	**-0.33%**		**8.01%**	**6.84%**
Actual Difference (Fund return less median return)				**0.98%**			**1.18%**

Model solution

To: XYZ Superannuation Fund

Dear Trustee,

ANALYSIS OF FUND PERFORMANCE FOR CALENDAR 2002

(1 mark for letter format)

As per our recent discussions, I have performed some initial analysis of the funds results over the 2002 calendar year. Specifically, you have asked me to comment on known and unknown sources of overperformance.

Key sources of differences between the performance of the XYZ Superannuation fund and the median manager performance, and indeed the performance of XYZ's Superannuation own benchmark will include:

- The extent to which the asset allocation of the XYZ Fund differs from the survey median. This has been significant over the past year, in particular the relative underweighting of domestic and international equities and the relative overweight positions in direct property, bonds and cash.

  (1 mark for comment + 4 marks for associated rough attribution analysis)

- While such deviations may be in part to movements away from the strategic benchmark asset allocation, my rough attribution analysis suggests that that the majority of the outperformance relative to the median manager can be attributed to the strategic asset allocation of the Fund. This is potentially a significant ongoing contributor to performance differences. Note that these calculations can only be considered approximate due to complications arising from fees, taxes and the frequency of calculations, etc.

  (1 mark)

- Stock selection and interaction effects (the impact of under/over weighting sectors where performance within that sector deviates from the benchmark index) can create divergences in performance.

  (1 mark)

- Different effective tax rates between funds can impact recorded after tax returns. For example, some funds may have tax losses being carried forward which can reduce current tax liabilities, improving current post tax returns.

  (1 mark)

- The Fund return is a crediting rate, whereas the managers in the survey will have used daily time weighted returns. Crediting rates are usually money weighted.

  (1 mark)

- Crediting rates typically have expenses deducted, which may tend to make them not directly comparable with

(1 mark)

- Fee arrangements and levels may differ between funds. (1 mark)

I shall refine these results and conclusions after the final data becomes available.

Yours Sincerely

The Actuary

(Maximum of 12 marks)

Part (b)

In order to assess the level of risk attaching to the implementation of the investment strategy the following calculations would be undertaken:

- Absolute Risk (or tracking error) = St Dev (Quarterly Returns) x 4

(½mark)

- Active Risk (or volatility)= St Dev (Quarterly Returns – Benchmark Returns) x 4

(½ mark)

Note that:

- Benchmark returns need to be adjusted for tax and fees (or quarterly fund returns need to be grossed up).

(½mark)

- For consistency, similar quarterly calculations of active risk and volatility should be prepared for surveyed funds rather than use the annualised monthly results.

(½mark)

Other issues that should be addressed would include:

- Difficulty in selecting a "benchmark" for direct property which is a significant part of the benchmark.

(½mark)

- Artificially low volatility often associated with direct property which is a significant portion of the benchmark.

(½mark)

- Potential valuation discrepancies with venture capital which can understate underlying volatility.

(½mark)

- Higher liquidity risks (as opposed to volatility risks) associated with direct property and venture capital.

(½mark)

(Maximum of 4 marks)

Part (c)

The following tables and charts would be useful for the Committee's purpose:

- Tracking error, excess returns, information ratio over different time periods.
- Regression or correlation analysis against capitalisation weighted indices (suspicion of a mid to small cap bias?).
- Philosophy suggests growth bias, however student should be aware that growth and value "style" indices are presently not available in Australia. Short of a full stock list, may test performance against "growth" sectors. Again, regression or correlation analysis could be used.
- Obtain a representative portfolio listing and calculate portfolio statistics versus benchmark at a single point in time. More simple measures that the student may mention include such as price to book and historic EPS growth. More sophisticated measures may also be mentioned.
- Correlation of excess returns with other managers being used (style fit) etc.

(Maximum of 4 marks, 1 mark per valid point)

QUESTION 2: AIMS

Coverage: Unit 1
Aim 2: Explain the main features within the general investment environment in Australia as they affect asset consulting, investment management and financial planning.

This question seeks to test the students understanding of how "big picture" issues that can impact economic systems. In a sense, this question could be framed as a more traditional asset-liability type question.

QUESTION 2 (9 marks)

Over recent years the quantum of Australian Commonwealth Government Debt has been reduced by virtue of a succession of Budget surpluses, including the privatisation of Government assets.

This has created issues for the domestic bond market. The reduced availability (and possibly the complete unavailability) of such investments runs contrary to demand from superannuation funds with relatively fixed allocations to fixed interest.

Further concerns have been raised in respect of using Government bond prices to generate the benchmark interest rates used to price corporate bonds.

It has been suggested that the Australian Government could encourage a healthy and liquid bond market by issuing bonds and then investing the proceeds in a portfolio of publicly traded assets, e.g. shares.

Comment on the difficulties inherent in this idea. (9 marks)

QUESTION 2: SOLUTION

Note: Key issues are the size of this portfolio and the conflicts of interest created.

The difficulties inherent in this idea include the following:

- The government is effectively taking a very large leveraged position in equities. The potential for asset-liability mismatch is large.
- For the government to create a debt market of sufficient depth and liquidity, it would need to issue a large amount of debt, and buy correspondingly large amount of equities. The size of this portfolio would make trading extremely difficult, meaning that the government would likely move markets each time it rebalanced its portfolio.
- The thought of having the Government as a significant holder of shares on its company register may be disconcerting for some companies. For example, one may look at the difficulties experienced by Telstra in this regard.

- The Government's fiscal position is closely linked to the economic cycle, with economic downturns leading to increased Government spending. At such times the Government's fiscal position would be likely be negatively impacted by poor returns on its share portfolio. This would hamper the government's ability to fund social welfare at the very times when such programs are needed most.
- Conversely, during buoyant economic times the fiscal position would be strong, creating a significant temptation for the Government to overspend when it should be reserving for harsher times ahead.
- Transaction costs are likely to be significant.

This creates several conflicts of interest for the Government:

- When making public policy decisions that might be in the broader public interest, but could hurt share prices, the Government becomes terribly conflicted.
- The Government is also conflicted when forced to make decisions that might confer advantage to companies that it does own and simultaneously disadvantage those that it does not.
- While independent, the interest rate decision-making processes at the Reserve Bank could come under even greater pressure than before.

(1 mark for each valid point, up to a maximum of 9 marks)

QUESTION 3: AIMS

Coverage: Unit 5
Aim 11: Demonstrate an understanding of the principles and techniques for managing other international investments.
Aim 12e: Outline the features and advantages of "alternative" asset classes such as: high yield debt, private equity, hedge funds, managed futures.

This question should prove quite challenging for students. It should stretch them to apply their knowledge to a "novel" situation.

QUESTION 3 **(20 marks)**

An Australian superannuation fund is considering an equity investment in an infrastructure asset. The particular investment under consideration is a toll road in the United States.

This toll road investment has the following characteristics:

- **It involves a concession to operate the toll road for a fixed period. 60 years of the concession period remain. Thereafter the asset reverts to the government.**
- **Tolls can be escalated with inflation.**
- **The toll road has been operating for several years and has an established record of patronage.**
- **The purchase of the toll road was made via a combination of debt and equity financing.**

The projected cash flows for the next five years are set out in the table below ($US millions).

Calendar year	2003	2004	2005	2006	2007
Revenue	100.0	104.0	108.2	112.5	117.0
Operating expenses	(35.0)	(36.1)	(37.1)	(38.2)	(39.4)
Tax	0	(1.0)	(2.0)	(2.0)	(3.0)
Cash flow available for debt service	65.0	67.0	69.0	72.2	74.6
Interest payable	(65.0)	(65.0)	(65.0)	(65.0)	(65.0)
Cash distributed to equity investors	0.0	1.9	4.0	7.2	9.6
Debt outstanding	1000.0	1000.0	1000.0	1000.0	1000.0
Interest rate	6.5%	6.5%	6.5%	6.5%	6.5%

As an adviser to the superannuation fund, you have been asked to assist the Trustee in the due diligence process.

(a) What are the particular attractions of toll road investments for a superannuation fund? **(3 marks)**

(b) What are the issues particular to <u>this</u> investment in the context of its suitability or otherwise for an Australian superannuation fund? (5 marks)

(c) What Australian dollar value would you place upon the equity in this toll road? State all assumptions and show all working.

You can assume that all income repatriated to Australia receives a credit for tax paid in the United States, i.e. there is no double taxation.

(9 marks)

(d) What further information would you request from the promoter of this investment before confirming your view as to what constituted a reasonable price for the investment? Explain why you would request each item. (3 marks)

QUESTION 3: SOLUTION

Part (a)

The attraction of toll road investments in general for a superannuation fund are likely to be:

- Diversification benefits. These assets tend to have a low correlation with other equity investments.
- They can be a form of "inflation hedge" as tolls are often linked to inflation – either by law or expectation.
- The cash flows are long-term nature – this can be useful for matching long-term liabilities.
- On a standalone (and ungeared) basis, they are generally low risk assets with stable underlying cash flows. They are relatively simple from an operational perspective, not key person dependent, have high operating margins, have some monopoly characteristics, and once patronage reaches a certain level it tends to be sticky and grows roughly in line with the broader economy.

(1 mark per valid point, up to a maximum of 3 marks)

Part (b)

The issues particular to this toll road investment for an Australian superannuation fund include:

- Currency. Equity distributions will be made in USD. This involves either accepting currency risk (which may have some diversification benefits in its own right) or hedging an uncertain cash flow.
- Tolls may well be linked either implicitly or by regulation to inflation – but this would be to a US inflation index. This linkage to the relevant Australian inflation index might well be tenuous.
- Gearing is relatively high, especially in the early years where it severely impacts on the level of equity distribution. Investors will be relying on growth in either tolls and

patronage or both to ensure that a reasonable level of equity distributions are forthcoming.

- How does this investment fit with the fund's broader investment strategy and benchmark asset allocations?
- What is the size of the investment being considered relative to the rest of the fund and the strategic benchmark for such investments?
- This investment provides exposure to a single asset. If the aim is to get exposure to alternative/infrastructure investments there are other alternatives that should also be considered, e.g. infrastructure trusts that permit exposure to a reasonably diverse array of infrastructure investments– allowing the fund to spread risk across several investments.
- What are the fund's requirements for liquidity? This is not likely to be an especially liquid investment – and the costs of exiting the investment are likely to be high.

(1 mark per valid point, up to a maximum of 5 marks)

Part (c)

Note to markers:

The key issues to address in the solution are:

- Discount rate assumption.
  - For the required equity return or equity risk discount rate, a "risk free rate plus risk premium appropriate to this asset class" approach should be used.
  - Given the stable nature of this asset class, the risk premium applied should be relatively low.
- Value on a geared or ungeared basis, using the appropriate WACC and then valuing the ungeared cash flows then deducting the value of the debt or else valuing the geared cash flows to obtain the value of the equity. The student should recognize that an unadjusted PE ratio valuation does not work well given the relatively high level of gearing – leading towards a DCF valuation.
- Value pre-tax or post tax. Given that full credit is received for tax paid in the US, valuing on a pre-tax basis is the better (simpler) option.
- Assumption for the rates of growth in the free cash flow beyond the term of the projections shown.
- An Australian dollar valuation has been requested. A reasonable FX rate assumption should be applied to the $US valuation derived.

Note that a reasonably wide range of valuations are acceptable given the very limited data (by necessity) and the large impact small changes in assumptions for discount and growth rates can have on the valuation. What we are trying to assess is the student's sense of what drives value (discount rates and growth rate), an ability to justify assumptions and their ability to apply their knowledge to what might be a novel situation for them.

Model solution calculations follow.

Assume that a 60% debt /40% equity gearing ratio is reasonable for this project. Not unreasonable given the very stable nature of the underlying cash flows.

Value on an ungeared, pre-tax basis. This requires a pre-tax, weighted average cost of capital to be used as the discount rate. We can value the asset on a pre tax basis given the assumption of credit for tax paid overseas being allowable in the home country.

(1 mark)

Assume a risk-fee rate of 5%, roughly appropriate given current US conditions. A US$ interest rate should be used given this is a $US asset. Assume that the future cost of debt is that rate used in the projections, i.e. 6.5%.

Further, assume an equity risk premium of 4% on top of a risk free rate of 5.5% (this rate is lower than the cost of debt as the cost of debt has a credit risk margin built into it). This gives us an equity-required rate of return of 9.5% for the equity invested in this asset. This risk premium is relatively low given the relatively low risk nature of the asset (established patronage and operating performance), tempered by the level of gearing being higher than one would find amongst most corporate borrowers.

This gives us a weighted average cost of capital of

60% x 6.5% + 40% x 9.5% = 7.7%

(3 marks)

Revenues and operating expenses grow at different rates. Revenues grow with increases in patronage as well as inflation linked toll increases. Assume a growth rate of 2.5% for inflation plus 1.5% patronage growth over the long term for revenues, giving a total revenue growth rate of 4% over the long term. Assume that expenses grow in line with CPI plus some allowance for the increase costs of higher patronage. Hence assume that expenses grow at 3% around over the long term. Ignore capital expenditure, or at least that such capital expenditure occurs in the distant future such that the impact on the value the asset today is negligible.

(2 marks)

Given that the concession is over a very long-term we can approximately value the asset using a perpetuity approach. That is, the asset value on ungeared year basis is equal to the present value of revenues less the present value of the expenses.

Asset value = 100 / (7.7% - 4%) – 35 / (7.7% - 3%) = US$ 1,958M

(1 mark)

The value of the equity of this investment is then equal to the value of the asset less for face value of the current debt. This gives a value for equity of:

$1958M - $1000M = $958M

(1 mark)

The question asks for an Australian dollar value for the asset. Assume an exchange rate of 0.54. This gives a current value of the equity of $958M/.54 = A$ 1,774M.

(1 mark)

(Maximum of 9 marks)

Part (d)

Further information that should be requested from the promoter should include:

- A patronage report. What are the key drivers and risk factors for the traffic forecasts. This is the principal risk.
- Engineering. Need to ensure that the road is in good condition and that future capital expenditure requirements are not unreasonable.
- Tax issues – what tax structuring, if any, has been used in the financing. What are the issues for the Australian investor in this entity?
- Debt structure/covenants, including hedging. This will potentially impact on the timing of payments to equity and equity returns.
- Expense structure, including any management fees. Obviously this impacts the equity return. One need to understand how long any contractual arrangements are in place and the value of these contracts (do they represent good value for equity investors?).

(1 mark per valid point, up to a maximum of 3 marks)

QUESTION 4: AIMS

Coverage: Unit 5
Aim 12a: Describe the various types of property investment and their characteristics.

This question is largely a property question, but also deals with the issues relating to using leverage when investing.

QUESTION 4 **(9 marks)**

You manage a portfolio of commercial properties for a specialist property funds management company (Deal Fever Management Pty Ltd). An opportunity to purchase a small CBD office building at what you consider to be a very reasonable price has arisen. Financing such a purchase, however, is not going to be easy. The trust that you manage is already close to its (admittedly low) gearing covenants, and hence this purchase cannot be funded via a straight debt financing. Further, while your investors have a good deal of confidence in your investment prowess, they are reluctant to commit further funds to your trust at this time, and have asked you to think creatively about how you might find alternative means of funding this purchase.

Not wanting to pass up this opportunity, you ask an investment banking acquaintance for some suggestions as to how one might raise the necessary funds.

She notes that the highest value property amongst your investments provides around 30% of the income of the portfolio. Further, the lease payments for this particular property are contractually fixed for the next 10 years (subject to CPI increases). She suggests that these contracted lease payments could be securitised and sold as a 10-year CPI linked bond. That is, the bondholder would not have security over the property - their recourse would be limited to the lease payments (a general obligation of the party or parties leasing the property).

Assume that securitising the lease payments in this way is both acceptable to your current investor base and complies with the Trust Deed.

(a) What are the risks inherent in the CPI linked security proposed by your investment banker friend – from the perspective of an investor in this security? (4 marks)

(b) How would raising funds in this way change the nature of your property investment portfolio? What are the primary risks in this approach? (5 marks)

QUESTION 4: SOLUTION

Part (a)

Note to markers: marks should be awarded for a discussion, not just for a listing of points.

- Liquidity risk. Index linked securities are notoriously illiquid.

- Credit risk. This risk has two (related) forms:

    - The risk that the creditworthiness of the leaseholder declines (e.g. a ratings downgrade), reducing the value of the bond.
    - The risk that the leaseholder actually defaults on its contractual payments.

- Of lesser concern is that in default, the recovery proceeds are typically advanced sometime after default has occurred. In this instance, a single one off payment may be employed to extinguish the liability. This has implications if the manager was using these long-term cash flows to match a specific liability and cannot find a suitable replacement at the time of default with the recovery proceeds.

- Inflation risk. This is the risk that inflation is low and payments from the security are less than expected. In such circumstances the investor could yield a capital loss on the bond.

- Insurable risks. What happens if the building is somehow destroyed? Are their appropriate insurance arrangements in place to ensure that debt holders are compensated for lost rental income in such an event?

(1 mark for each valid point, maximum of 4 marks)

Part (b)

The securitised cash flows are now longer available to service the pre-existing debt - although the income from the new building should “replace” this to some extent (it may be more or less – the question does not specify this).

Raising funds via securitisation in this way increases the ***effective*** gearing of the trust. Cash flows to investors may potentially become more “back ended.” This makes it a more interest rate/risk discount rate sensitive investment. The portfolio has probably become a higher risk/higher return portfolio compared to its previous composition - although the student should note that this is not of too much concern as current gearing levels are quite conservative and investors appear to be happy for the manager to proceed down this path.!

Assuming that deductions within the trust are passed through to investors, the higher effective debt levels will give rise to higher levels of interest deductions – although again this could be offset by the increased income from the new building.

With the addition of another property, the portfolio is now more diversified – an important benefit.
The debt liabilities may also be more diversified and perhaps better matched to the portfolio – assuming that the pre-existing debt was standard floating or fixed interest rate debt.

By securitising the lease payments one has passed on the risk of default on these payments to the related bondholders. No doubt this has a cost.

(4 marks, 1 mark for each valid point)

The primary risks associated with this approach stem from the higher effective gearing. There is quite possibly a higher risk of the existing creditors putting the portfolio into default to the detriment of the unit holders/investors.

This could also be expressed as a form of greater liquidity risk for the trust – short-term cash flow problems are more likely than before, especially if the new property does not perform.

(1 mark)

(Maximum of 5 marks)

QUESTION 5: AIMS

Coverage: Units 1 and 4
Aim 4: Critically review the framework of modern financial economics
Aim 10: Demonstrate an understanding of the principles and techniques for managing an Australian equities portfolio

This is a relatively challenging question that tests the student's knowledge of quantitative investing techniques.

QUESTION 5 (23 marks)

A US fund manager's equity investment approach is based on the following fundamental beliefs:

- **Investment Trends tend to last for relatively long periods of time, longer in fact than most investors would expect. These trends can be successfully identified, measured and exploited by a quantitative approach to investment management.**

- **Positive Business Momentum and improving fundamentals have been and will be critical indicators of a company's future stock price performance.**

- **Market Recognition is a critical factor in choosing companies to include in a portfolio. Until the market recognises the potential in a company or its valuation it is likely to under perform the rest of the market.**

(a) Discuss these beliefs and whether or not you believe that they are likely to hold true for the Australian market. (6 marks)

The firm has examined a vast amount of data and has arrived at the following stock selection model.

Valuation (26%)	
Price/Free cash flow	**Current price divided by cash earnings.**
Price/Trailing Earnings	**Current price divided by the last four-quarter earnings.**
Price Reversal	**Relative, long-term price reversal.**
Business Momentum & Earnings Quality (40%)	
Capital Expenditures Intensity	**Year on year change in ratio of capital spending to depreciation.**
Change in Accruals	**Four quarter change in working capital.**
Market Recognition (34%)	
Estimate Revision	**Direction and magnitude of recent earnings estimate revisions.**
Price Momentum	**Relative price performance.**

(b) Discuss, with reasons, why each of these factors might have been selected for investigation for possible inclusion in the firm's stock selection model.
(7 marks)

(c) Give three other quantitative factors that could also have been back-tested and your reasons as to why they might add value. (6 marks)

The manager's portfolio is then constructed by the following process.

Once the model has evaluated all individual companies in the S & P 500 on the combined results of the components described above, an overall rank for each stock is developed and expressed on a decile basis. The manager will then purchase approximately 400-440 companies, significantly overweighting well-ranked stocks (top two deciles), equally weighting those stocks in the middle, and underweighting poorly ranked (8th & 9th decile) stocks. <u>Bottom decile stocks are not owned.</u>

The manager's current weighting scheme is as follows:

Decile Rank	Portfolio Weighting (relative to S&P 500 Index)
1	170% Significant Overweight
2	135% Modest Overweight
3-7	100% Equal Weight
8	95% Modest Underweight
9	40% Significant Underweight
10	0 % Not owned

Minimisation of stock specific risk is a function of the following:

- **The portfolio holds a large number of stocks (400-440 issues).**
- **Some 300 of these stocks are essentially market weighted.**
- **Another 50 stocks (decile 9) are owned (but underweighted relative to the benchmark) even though the model predicts that they are likely to under perform.**

This has lead to extremely low levels of tracking error.

(d) If an Australian manager attempted to introduce a similar process for a $2 billion portfolio in the Australian market, what would be the most significant practical problems such a strategy would face? (2 marks)

(e) Assuming the expected value added of the Australian portfolio is the same as that for the American one, would you expect it to have the same information ratio (give reasons for your answer)? For the purposes of this part of the question you may assume that the quant factors do add value.
(2 marks)

QUESTION 5: SOLUTION

Part (a)

Investment trends

This tenet requires at least a partial rejection of the efficient markets hypothesis. This is not necessarily unreasonable – otherwise there would be little basis for engaging in active management.

Further, Australian equity managers have an enviable track record of outperformance compared with their counterparts in the US and other developed markets.

The assertion that trends may continue longer than expected is consistent with behavioural finance theories suggesting that people tend to over-react when they change their minds, causing markets to overshoot. There is no reason why the findings of behavioural finance research are not applicable in Australia.

(3 marks)

Positive Business Momentum & Improving Fundamentals

[Note: This is relatively hard as "Positive Business Momentum" does not have a precise technical meaning.]

This refers to the ***change*** in fundamentals (momentum equals movement) rather than the fundamentals themselves. It is interesting that the fundamentals themselves are not factors – this implies a strong form efficient market.

However it also implies that people often under-react to such change and hence acting on the change quickly can add value. Again this theory is one of the tenets of behavioural finance and there is no reason why it isn't applicable in Australia.

(2 marks)

Market Recognition

Market recognition could be measured by price momentum or analysts' recommendations or changes in analysts' forecasts. All these things can be shown to add some value (despite price momentum working suggesting the market isn't weak form efficient).

(1 mark)

(Maximum of 6 marks)

Notes to markers:

- General Answer – All these factors are related to behavioral economics. This requires a rejection of traditional thinking regarding efficient markets. There is no reason why they wouldn't work in Australia (and in fact it can be demonstrated empirically that they do work). 1 mark can be awarded fro this recognition of this point – subject to maximum marks for the question.

- Contrary views are acceptable providing that a reasonable supporting explanation is put forward.

Part (b)

Reasons for choosing to examine these factors may include the following:

1. Business Momentum & Earnings Quality (40%)

- Capital Expenditures Intensity
  - May provide direction regarding future business issues. A reduction in capex may suggest cash flow pressure.
  - Positive capex indicates business optimism by management (the people who know the business best)

- Change in Accruals
  - We are trying to measure earnings quality, not just earnings
  - Working capital is increased by cash profit. This measure tries to identify genuine earnings rather than accounting manipulations.

(1 mark for each valid point, maximum of 2 marks)

2. Market Recognition

- Estimate Revision
  - Direction and magnitude of recent earnings estimate revisions.

  If analysts are changing their earnings estimates this means they recognise the stock. Upwards revisions mean they are positive about what the business is doing. Broker recognition should lead to people wanting to buy.

- Price Momentum
  - Relative price performance.

  This is the simplest measure of Market Recognition – almost by definition. Prices go up when there is more buying than selling.

(1 mark for each valid point, maximum of 2 marks)

3.Valuation

- Price/Free cash flow
  - Current price divided by cash earnings.

  Price to earnings is a pretty fundamental measure of valuation.
  Cash earnings again chosen to minimise the impact of accounting manipulation.

- Price/Trailing Earnings
  - Current price divided by the last four-quarter earnings.

  Again a version of price to earnings.

Historical earnings might be used because it is more certain than prospective earnings and less open to manipulation. It is also publicly available. Past estimates of future earnings might be harder for a quantitative manager to come across.

- Price Reversal
  - Relative, long-term price reversal.

Because behavioral finance suggests people extrapolate recent trends, prices may tend to overshoot.

This will include extrapolation "extraordinary" earnings growth or returns on capital. In a highly competitive market, it is unlikely that abnormal earnings can be maintained in the long term. This suggests mean-reversion, i.e. long-term relative price reversal.

(1 mark for each valid point, maximum of 3 marks)

(Maximum of 7 marks in total)

Part (c)

Other factors that could have been chosen for each of these three categories include:

1. Business Momentum & Earnings Quality (40%)

- Expected Earnings Growth
  - Growth managers believe earnings growth drives returns.
  - Ultimately "Business Momentum" is about generating earnings
- Ratio of EBITDA (Earnings before interest and Tax and depreciation) to NPAT (Net Profit after Tax)
  - The first line (EBIT) is less susceptible to manipulation than NPAT. Hence this is a measure of earnings quality.

2. Market Recognition

- Broker Recommendations
  - Brokers might add some value with their recommendation. Clearly a measure of market recognition.
- Change in volume traded
  - Often indicates somebody knows something about a stock (or thinks they do). Again is clearly market recognition.

3. Valuation

- Price to Book.
  - A traditional "mainstay" for identifying companies that are undervalued, and potential takeover targets.

(2 marks for each valid point with accompanying reasons, maximum of 6 marks)

Marker's guide: One can award half marks for tenuous points. Note that there are potentially many plausible answers, but all put forward must be plausible and have a supporting argument to get full marks for the factor put forward.

Part (d)

The biggest single issue is that the $2 billion fund size combined with the market's depth/illiquidity the number of stocks that could be traded in a reasonable period of time using this process is very small (100 max). This leads to the two "size" points below.

If an Australian manager attempted to introduce a similar process in the Australian market, the most significant practical problems that this strategy would face would include:

- Size of the market. Diversifying stock selection bets across many companies might be very difficult. The number of listed companies to choose from is relatively small.
- A related point is the relative lack of diversity of companies listed on the Australian stock exchange. The differences of these companies with respect to these factors may not be sufficiently large.
- Market depth/liquidity. To get something approaching the required spread of stock bets, one will have to invest in some relatively small capitalization stocks. These stocks are notorious for their illiquidity. Issues in terms of the market impact of taking positions in these stocks (and ultimately realizing these positions) will have to be considered.

(1 mark for each valid point, up to a maximum of 2 marks)

Part (e)

The information ratio is defined as:

Value Added divided by Tracking Error (1 mark)

It is also the Information Coefficient (Value Added divided by Tracking Error **per position**) times the number of positions.

Therefore the Australian portfolio would have a lower information ratio as the number of stocks available (i.e. the number of bets available) is lower.

(1 mark)

QUESTION 6: AIMS

Coverage: Units 3 and 5
Aim 9: Demonstrate an understanding of the principles and techniques for investing in fixed interest securities
Aim 11: Demonstrate an understanding of the principles and techniques for managing other international investments

The aim of this question is to give the student the opportunity to demonstrate their understanding of yield curves, asset liability management using bonds, and the concept of duration.

QUESTION 6 (19 marks)

Show all working. Unless otherwise stated, calculate all yields to the nearest basis point (0.01%). Ignore transaction costs.

It is roughly 98 years into the future (i.e. 1 January 2100).

Australia and New Zealand remain as separate sovereign nations, each with their own interest rate and currency markets.

All derivatives traded in 2002 remain.

You are the actuary and investment manager for a medium-sized general insurance company.

(a) The Australian short-term money market (in the year 2100 this encompasses all maturities less than or equal to one year) is undergoing temporary liquidity problems. Enterprising market players, however, can create synthetic Australian dollar (AUD) deposits using the New Zealand short-term money market and various currency contracts. New Zealand has a massive current account surplus and their debt is rated AAA by S&P.

The following forex and bill rates are available for New Zealand.

Days	Bill rate	NZD per AUD 1.00
spot	-	1.400
91	3.25%	1.395
183	3.50%	1.390
274	3.75%	1.385
365	3.99%	1.380

For your portfolio you also decide to employ such methods, creating a synthetic 1-year risk-free deposit by buying New Zealand dollars (NZD), investing in New Zealand T-Notes, and forward selling NZD to convert the maturity proceeds back to AUD.

Calculate the proceeds in 1 year of an AUD 1 million investment and hence the yield on a synthetic 1-year deposit. (2 marks)

(b) Beyond the short-term rates, there is a liquid AUD forward interest rate market for terms out to five years.

n	f(1,n)	f(n-1,n)	z(n)
1			
2	6.00%		
3		6.30%	
4	6.27%		
5		6.60%	

Complete the above table of forward and zero coupon rates for the Australian market. Note that the table above uses the following notation:

- **f(i,j) is the per annum interest rate applying from time i years to time j years.**
- **z(n) is the zero coupon interest rate (per annum) applying over a term of n years from time zero. (6 marks)**

(c) Your boss says: "The yield curve is normal-shaped (upward sloping). We could increase our profit by holding assets longer than the liabilities." Of the hypotheses explaining the shape of yield curves, which one is most supportive of this assertion? Briefly explain.

Why might this approach fail to work in practice? (3 marks)

(d) Your company has expected outstanding liabilities due as follows (one value to be calculated):

Date	Cash flow ($m)
1/1/2101	10
1/1/2102	10
1/1/2103	10
1/1/2104	e

Your assistant says "By coincidence, the discounted mean term (calculated using NZD cash flow amounts and the NZD yield) Telecom NZ 1/1/2103 6% annual coupon bond [rated A- by S&P] has exactly the same discounted mean term as the liabilities (calculated using the Australian dollar cash flows and Australian interest rates)."

Assuming he is correct, calculate the missing value "e" in the table above, to the nearest $0.1m. The NZD market yield of the Telecom NZ bond is 6.5% p.a.(annual compounding). (4 marks)

(e) You assistant continues, "Since the NZD tracks the AUD so closely, currency risk is minimal. Let's just immunise the fund with the bond, and collect the yield pick-up as profit."

Briefly discuss 4 investment risks that adopting this suggestion would create, relative to a perfectly matched fund holding risk-free assets. Ignore regulatory and statutory capital issues. (4 marks)

QUESTION 6: SOLUTION

Part (a)

On day 1, the AUD 1million must be converted into NZD. This provides $1.4million NZD, which is invested at 3.99% for one year.

1,400,000 x (1+3.99%) = 1,455,860.

At the end of the year, this amount is swapped back into AUD (using a prearranged AUD swap for the above amount).

This gives an AUD amount for the proceeds of the investment at the end of the year of:

1,455,860 / 1.380 = A$1,054,971.

This equates to a per annum yield of:

$1,054,971 / 1,000,000 – 1 = 5.5% (2 marks)

Part (b)

For these calculations, we need the formula:

$[1+ Z(n)]^n = [1+f(0,1)] \times [1+f(1,n)]^{n-1}$ to solve for Z(n); and

$[1+ Z(n)]^n = [1+f(n-1,n)] \times [1+z(n-1)]^{n-1}$ to solve for f(n-1,n)

Hence our calculations are as follows:

Year 1 (n=1):

Z(1) = 5.50% as per Part a.

Year 2 (n=2):

F(1,2) = f(1,n) = 6%

$[1+ Z(2)]^2 = [1+f(1,2)] \times [1+z(1)]$
$[1+ Z(2)]^2 = [1+6\%] \times [1+5.5\%]$
Z(2) = 5.75%

Year 3 (n=3):

$[1+Z(3)]^3 = [1+f(2,3)] \times [1+z(2)]^2$
$[1+Z(3)]^3 = [1+6.3\%] \times [1+5.75\%]^2$
$Z(3) = 5.93\%$

$[1+Z(3)]^3 = [1+f(0,1)] \times [1+f(1,3)]^2$
$[1+5.93\%]^3 = [1+5.5\%] \times [1+f(1,3)]^2$
$f(1,3) = 6.15\%$

Year 4 (n=4):

$[1+Z(4)]^4 = [1+f(0,1)] \times [1+f(1,4)]^3$
$[1+Z(4)]^4 = [1+5.5\%] \times [1+6.27\%]^3$
$Z(4) = 6.08\%$

$[1+Z(4)]^4 = [1+f(3,4)] \times [1+z(3)]^3$
$[1+6.08\%]^4 = [1+f(3,4)] \times [1+5.93\%]^3$
$f(3,4) = 6.53\%$

Year 5 (n=5):

$[1+Z(5)]^5 = [1+f(4,5)] \times [1+z(4)]^4$
$[1+Z(5)]^5 = [1+6.6\%] \times [1+6.08\%]^4$
$Z(5) = 6.18\%$

$[1+Z(5)]^5 = [1+f(0,1)] \times [1+f(1,5)]^4$
$[1+6.18\%]^5 = [1+5.5\%] \times [1+f(1,5)]^4$
$f(1,5) = 6.35\%$

Hence the completed table looks as follows (numbers in bold are the answers required).

n	f(1,n)	f(n-1,n)	z(n)
1			**5.5%**
2	6.00%	**6.0%**	**5.75%**
3	**6.15%**	6.30%	**5.93%**
4	6.27%	**6.53%**	**6.08%**
5	**6.35%**	6.60%	**6.18%**

(1/2 mark for each correct answer, 1.5 marks for an outline of the correct approach)
(Maximum of 6 marks)

Part (c)

The liquidity preference theory supports the boss' assertion. This theory states that investors generally prefer to commit to short-term investments rather than long-term

investments, implying that a liquidity "premium" must be offered to investors to induce them to invest for longer terms. Hence a positive-sloping yield curve results. The strategy of holding assets longer than the liabilities means that, given a stable yield curve, this premium can be earned by the company.

This approach may not work in practice as:

- The value of the assets will likely be more volatile than that of the liabilities, due to their (likely) higher duration.
- There is also the possibility of nonparallel shifts in the yield curve to that could also lead to losses of capital (assets less liabilities) – due to the adverse change in the value of assets being greater than the reduction in the liabilities.
- General insurance liabilities may have a discounted mean term that is longer than that of the available assets.
- Liability estimates are highly uncertain, such that the variability of the liability values may be much greater than that for assets.

(Maximum of 3 marks, 1 mark per valid point)

Part (d)

For the Telecom NZ Bond:

$c\ {}_tv^t = 6a_3 + 100v^3$ @ 6.5% = 98.6758 (½mark)

$t\,c\ {}_tv^t = 6(Ia)_3 + 3 \times 100v^3$ @ 6.5% = 279.4697 (½mark)

Discounted mean term = DMT

DMT = 98.6758 / 279.4697 = 2.8322 years. (½mark)

For the AUD liabilities:

$c\ {}_tv^t = 10 \times \{1.055^{-1} + 1.0575^{-2} + 1.0593^{-3}\} + e.v^4 = 26.8336 + e.v^4$ (½mark)

$t\,c\ {}_tv^t = 10 \times \{1.055^{-1} + 2 \times 1.0575^{-2} + 3 \times 1.0593^{-3}\} + 4e.v^4 = 52.6014 + 4e.v^4$ (½mark)

DMT = $(52.6014 + 4e.v^4) / (26.8336 + e.v^4)$ = 2.8322 years as above. (½mark)

Rearranging gives:

$e = (1.0608)^4 \times (2.8322 \times 26.8336 - 52.6014) / (4 - 2.8322)$
= \$25.3702M
= \$25.4M

(1 mark)
(Maximum of 4 marks)

Part (e)

The risks that this strategy creates are:

- Default risk. This is the risk that Telecom NZ defaults, i.e. fails to honour its debt obligations.
- Non-default credit risk. Telecom NZ credit rating could be downgraded, decrease the value of the matching asset without having an impact on the value of the liabilities. Also, credit risk spreads could blow out even without a ratings downgrade (for all A-issuers, for example), producing a similar effect.
- Changes in the relativities of the yield curves in the two countries.
- Currency risk (of course). There is always the possibility that political risk, inflation risk, etc, could impact on relationships that have historically existed between the currencies and interest rates of two different countries.
- Convexity risk. Non-parallel shifts in the yield curve can render duration matching strategy ineffective.
- Taxation risk. There is the risk of changes in taxation law in either country.
- Where the liabilities can change, there may a need for liquidity in the bond. The Telecom NZ bonds will be less liquid than equivalent risk-free securities that could be held as a "perfect match". This presents an additional risk.

(1 mark per valid point, up to a maximum of 4 marks)

END OF PAPER TWO SOLUTIONS