INV2601 DISCUSSION CLASS SEMESTER 2

INVESTMENTS: AN INTRODUCTION

INV2601

DEPARTMENT OF FINANCE, RISK MANAGEMENT AND BANKING

UNISA college of economic and management sciences

Examination

- Duration of exam – 2 hours.
- 40 multiple choice questions.
- Total marks = 40.
- Tested on study units 1 – 15 (Topic 5 study unit 16 is excluded).
- Interest factor tables and formula sheets are not provided.
- I encourage you to create your own formula sheet that you use in your revision for each chapter.
- Examination includes both theory and calculations.
- Use four decimal places in your calculations and round off your final answer to two decimal places.

How to adequately prepare for the exam

- Thoroughly read and understand the content in the textbook and study guide for each chapter.
- Do all the assessment questions in the textbook and study guide for each chapter.
- Review all your assignment questions.
- Do all the self assessment questions that have been uploaded on myUnisa.
- Ensure that you understand all the material covered in the discussion class.
- Go through all the past exam papers on myUnisa. The solutions to the exam papers are also available on myUnisa. Do not use the past exam papers as your only source of revision.

Mark Composition

	Questions	Percentages
Theory	21	52.5
Calculations	19	47.5
Total	**40**	**100%**

		Questions
Topic 1	The Investment Background	15
Topic 2	Equity Analysis	5
Topic 3	The Analysis of Bonds	5
Topic 4	Portfolio Management	15
Total		**40**

Chapter 1

- **Risk vs Return**
- Risk is the uncertainty about whether an investment will earn its expected rate of return.
  - Measure of risk of a single asset:
    - Standard deviation
    - Coefficient of variation (CV)

- Return is the sum of the cash dividends, interest and any capital appreciation or loss resulting from the investment.
  - Historical return can be calculated using the following:
    - HPR
    - HPY
    - “Real” rate of return

- The risk and return principle:
  - The greater the risk, the higher the investor’s required rate of return.

Example - Coefficient of Variation

- Calculate the Coefficient of Variation (CV) of Green Ltd given the following information.

Possible outcomes	Probability(%)	Return(%)
Pessimistic	20	5
Most Likely	30	8
Optimistic	50	10

$$CV = \frac{\delta}{E(r)}$$

$$E(r) = (0.20 \times 5) + (0.30 \times 8) + (0.50 \times 10)$$

$$= 8.40\%$$

$$\delta = \sqrt{[0.20(5 - 8.40)^2] + [0.30(8 - 8.40)^2] + [0.50(10 - 8.40)^2]}$$

$$= \sqrt{3.64}$$

$$= 1.9079$$

$$CV = \frac{1.9079}{8.40}$$

$$= 0.23$$

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Chapter 3 –Investment Theory

- **Risk and Return: The Security Market Line (SML):**
- For any level of risk, the SML indicates the return that could be earned by using the market portfolio and the risk-free asset.
  - An investor with a high risk aversion will choose an optimal investment that offers a low rate of return hence a lower risk.
  - An investor with a low risk aversion will choose an optimal investment that offers a higher rate of return for additional (higher) risk.
- NB: Ensure that you know the causes to the changes to the SML.
  - (ie. movement along the SML, changes in the slope of the SML and the parallel shift of the SML).

- **Systematic and Unsystematic risk:**
- An investor is not compensated for unsystematic risk because it is diversifiable.
- Systematic risk is measured by beta (β). It is un-diversifiable because it is caused by factors that affect the entire market. The only risk that a well diversified portfolio has is systematic risk.
- Unsystematic risk is diversifiable because it is caused by factors that are unique to the company.
- Systematic risk + Unsystematic risk = Total risk.
- Total risk is measured by the standard deviation.

Capital Asset Pricing Model – CAPM

- CAPM indicates the return an investor should require from a risky asset assuming that he is exposed only to an asset’s systematic risk as measured by beta (β).
- Required rate of return based on CAPM:

$$k = r_f + \beta(r_m - r_f)$$

- **Example:**
- The risk-free rate of return is 8% per annum and the rate of return of the market is 12%. The beta of Hedge Corporation is 1.4. Calculate the required rate of Hedge Corporation using the Capital Asset Pricing Model (CAPM).

$$k = r_f + \beta(r_m - r_f)$$

$$= 8 + 1.4(12 - 8)$$

$$= 13.60\%$$

Using CAPM to assess an asset

- An investment in an asset can be assessed by means of CAPM to determine whether an asset is over or undervalued.
- Estimated rate of return – is the actual holding period rate of return (HPR) that the investor anticipates.
  - Estimated rate of return > required rate of return
    - The share is undervalued.
    - Investment decision: you will buy the share.

  - Estimated rate of return = required rate of return
    - The share is properly valued.
    - Investment decision: you will hold the share.

  - Estimated rate of return < required rate of return
    - The share is overvalued.
    - Investment decision: you will sell the share.
- Highly efficient market – all assets should plot on the SML.
- Less efficient market – assets may at times be mispriced due to investors being unaware of all the relevant information.

Example – Using CAPM to assess an asset

- You believe the share of Brown Stone Ltd has an estimated rate of return of 20%. The beta of Brown Stone Ltd is 0.80, the expected rate of return of the market is 12% and the risk-free rate of return is 8%. Calculate the required return by using CAPM and determine whether you will buy or sell the Brown Stone Ltd's share.

$$Estimated\ rate\ of\ return = 20\%$$

$$Required\ rate\ of\ return = r_f + \beta(r_m - r_f)$$

$$= 8 + 0.8(12 - 8)$$

$$= 11.20\%$$

$$Estimated\ rate\ of\ return > Required\ rate\ of\ return$$

$$20\% > 11.20\%$$

The share is undervalued.

It is undervalued by 8.80% (= 20 − 11.20).

You will buy the share.

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Chapter 4 – NPV & IRR

- Yellow Ltd has a required rate of return of 5%. They invest R40 000 with Red Capital and can earn the following annual cash flows over the next 5 years.

Year	Cash Inflows
1	R8 000
2	R12 000
3	R14 000
4	R16 000
5	R18 000

- Calculate the **NPV** and **IRR** of the investment and determine the **investment decision** that should be taken as a result.

NPV & IRR

	INPUT
CF 0	-R40 000
CF 1	R8 000
CF 2	R12 000
CF 3	R14 000
CF 4	R16 000
CF 5	R18 000
I/YR	5%
COMP NPV	R17 863.84
COMP IRR	18.04%

The investment is acceptable because the NPV is greater than R0 and the IRR is greater than the required rate of return.

Chapter 5: Valuation Principles and Practices

Constant growth model:

- Chevy Limited's current dividend is R2.00 per share and its market price is R32.00. It has a required rate of return of 10% and its dividend is expected to level off to a constant grow rate of 4% per year. Calculate the intrinsic value of the share using the constant growth model.

$$V = \frac{D_1}{k - g}$$

$$= \frac{2.08}{0.10 - 0.04}$$

$$= R34.67$$

$$Where:$$

$$D_1 = D_0 \times (1 + g)$$

$$= 2(1.04) = R2.08$$

Valuation

- Assume Chevy Limited had the following market price, what would be it's valuation:

Market price	Valuation
R29.22	Undervalued
R34.67	Properly valued
R45.30	Overvalued

- Market price < Intrinsic value
  - The share is undervalued. Investment decision: you will buy the share.

- Market price > Intrinsic value
  - The share is overvalued. Investment decision: you will sell the share.

- Market price = Intrinsic value
  - The share is properly valued. Investment decision: you will hold the share.

Three-stage dividend model

- Global Corporation has just paid dividends of R1.00 per share. Assume that dividends will grow as follows: 10% in year one and two and 20% in year three. After that growth is expected to level off to a constant growth rate of 5% per year. The required rate of return is 12%. Calculate the intrinsic value using the multistage model.

$$Step\ 1: Determine\ the\ expected\ future\ cash\ flows$$

$$D_1 = 1.00(1.10) = 1.10$$

$$D_2 = 1.10(1.10) = 1.21$$

$$D_3 = 1.21(1.20) = 1.4520$$

$$D_4 = 1.452(1.05) = 1.5246$$

$$Where \quad P_3 = \frac{D_4}{(k-g)}$$

$$= \frac{1.5246}{0.12 - 0.05}$$

$$= 21.78$$

$$Step\ 2: Calculate\ the\ intrinsic\ value$$

$$V_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \frac{P_3}{(1+k)^3}$$

$$= \frac{1.10}{1.12^1} + \frac{1.21}{1.12^2} + \frac{1.452}{1.12^3} + \frac{21.78}{1.12^3}$$

$$= 0.9821 + 0.9646 + 1.0335 + 15.5026$$

$$= R18.48$$

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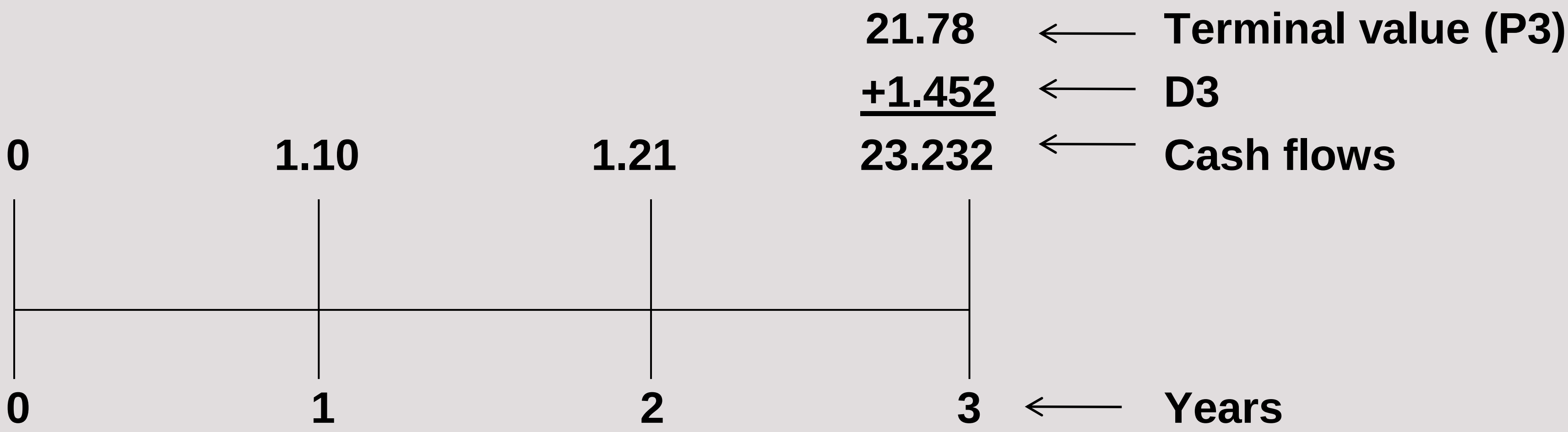
Three-stage dividend model (Alternative calculation)



	INPUTS	
CF0	0	
CF1	1.10	
CF2	1.21	
CF3	23.232	(21.78+1.452)
I/YR	12%	
COMP NPV	R18.48	

Growth Rate

Bull and Bear Limited	
Dividend payout ratio	40%
Net profit margin	20%
Total asset turnover	1.5
Financial leverage	1.2

- Calculate the growth rate of Bull and Bears Limited.

$$g = Return\ on\ equity\ (ROE)\ \times Retention\ Rate (RR)$$
$$= 36\% \times 0.60$$
$$= 21.60\%$$

$$Where:$$

$$ROE = net\ profit\ margin \times total\ asset\ turnover \times financial\ leverage$$
$$= 20 \times 1.5 \times 1.2$$
$$= 36\%$$

$$Retention\ rate\ (RR) = 1 - dividend\ payout\ \left({}^{D}/_{E}\right)$$
$$= 1 - 0.40$$
$$= 0.60$$

Chapter 6: Fundamental Analysis

Analysis of macroeconomic factors

Asset allocation based on economic prospects

Industry analysis

Which industries will gain from economic prospects?

Company Valuation

Companies that will benefit most from the economic prospects

Which ones are undervalued?

Chapter 11: Bond Fundamentals

- Bonds are issued in the capital market (financial market for long term debt obligations and equity securities).
- Bonds provide an alternative to direct lending as a source of funding.
- Basics of bonds:
  - Principal value/Face value/Par value (FV)
  - Coupon rate (PMT)
  - Term to maturity (N)
  - Market value (PV)
  - Yield to maturity (I/YR)

- [Ensure that you know all the alternative bond structures covered in the chapter.]

Yield to Call

- Calculate the yield to call of a 10% quarterly paying bond with a par value of R1 000. The bond matures in 25 years, has a market price of R1 099.10 and a yield to maturity of 9%. It is callable by the issuer in 10 years at a call price of R1 340.

	INPUTS	
FV	1 340	
PV	-1 099.10	
PMT	25	(100÷4)
N	40	(10×4)
COMP I/YR	2.5931×4	
	10.37%	

- NB: Replace the par value with the call price and the time to maturity with the call date. The market price and coupon payment remain the same.

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Duration

- Properties of duration:
  - Duration of a zero coupon bond will equal its term to maturity
  - Duration of a coupon bond will always be less than its term to maturity
  - Positive relationship between term to maturity and duration
  - Inverse relationship between coupon and duration
  - Inverse relationship between yield to maturity and duration

Convexity

- Convexity adjustment accounting for the convex shape of the price-yield curve improves the accuracy of the duration measure.
- Duration ignores the curvature of the price-yield relationship:
    - It is a poor approximation of price sensitivity to larger yield changes
    - Increases in price are underestimated
    - Decreases in price are overestimated

Example

- A 15 year, 8% semi-annual coupon bond (R1 000 par value) is priced at a yield to maturity of 10%. The yield changes by 150 basis points.
- Calculate the effective duration of the bond.
- Calculate the effective convexity of the bond.

	V-	**V_0**	**V+**
FV	1 000	1 000	1 000
PMT	40	40 (80÷2)	40
N	30	30 (15×2)	30
I/YR	4.25 [(10-1.50)÷2]	5 (10÷2)	5.75 [(10+1.50)÷2)]
PV	**958.05**	**846.28**	**752.53**

$$NB: 1\% = 100 \; basis \; points$$

$$150 \; basis \; points = \frac{150}{100} = 1.50\%$$

Effective Duration

	V-	V_0	V+
FV	1 000	1 000	1 000
PMT	40	40 (80÷2)	40
N	30	30 (15×2)	30
I/YR	4.25 [(10-1.50)÷2]	5 (10÷2)	5.75 [(10+1.50)÷2)]
PV	**958.05**	**846.28**	**752.53**

$$Effective\ duration = \frac{V_{-} - V_{+}}{2V_0(\Delta y/100)}$$

$$= \frac{958.05 - 752.53}{2 \times 846.28 \times (1.50/100)}$$

$$= \frac{205.52}{25.3884}$$

$$= 8.10$$

Effective Convexity

	V-		V_0		V+	
FV	1 000		1 000		1 000	
PMT	40		40	(80÷2)	40	
N	30		30	(15×2)	30	
I/YR	4.25	[(10-1.50)÷2]	5	(10÷2)	5.75	[(10+1.50)÷2)]
PV	**958.05**		**846.28**		**752.53**	

$$Effective\ convexity = \frac{V_- + V_+ - 2V_0}{2V_0(\Delta y/100)^2}$$

$$= \frac{958.05 + 752.53 - (2 \times 846.28)}{2 \times 846.28 \times (1.5/100)^2}$$

$$= \frac{18.02}{0.3808}$$

$$= 47.32$$

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Duration and Convexity Effect

- Duration Effect

$$\%\Delta P_D = -D(\pm\Delta y)$$
$$= -8.10(\pm 1.50)$$
$$= \pm 12.15\%$$

- Convexity Effect

$$\%\Delta P_c = C\left(\frac{\Delta y}{100}\right)^2 \times 100$$
$$= 47.32\left(\frac{1.50}{100}\right)^2 \times 100$$
$$= 1.06\%$$

Chapter 13: Derivative Instruments

- Major categories of derivatives instruments
  - Forwards:
    - Agreement between two parties in which one party the buyer agrees to buy from the other party, the seller, an underlying asset at a future date at a price established today.
    - The contract is customized - (privately traded on an over the counter (OTC) market.
    - Risk of default by either party is high
  - Futures:
    - Agreement between two parties in which the buyer agrees to buy from the seller, an underlying asset at a future date at a price established today.
    - Public traded on a futures stock exchange.
    - Standardized transaction.
    - No risk of default by either party.

Derivative Instruments

- Options:
  - Call option: the right to buy a specific amount of a given share at a specified price (strike/exercise price) during a specified period of time.
    - Provided the market price (S) exceeds the call strike(X) before or at expiration. NB: **S > X**
  - Put option: the right to sell a specific amount of a given share at a specified price (strike price) during a specified period of time.
    - Provided the put strike price (X) exceeds the market price (S) before or at expiration. NB: **X > S**
- Swaps:
  - An agreement between two parties to exchange a series of future cash flows.
  - A variation of a forward contract; equivalent to a series of forward contracts.

Arbitrage Opportunity

- Any deviation from the theoretical or fair value as calculated may lead to a specific arbitrage strategy to exploit and profit from this discrepancy.

- Principle: **Buy low** and **sell high**

- Cash and carry arbitrage (market price **P** > theoretical price **F**)
  - Sell the futures contract at the quoted market price (P)
  - Borrow money at the risk-free rate for the period until expiry
  - Buy the underlying at the spot price

- Reverse cash and carry arbitrage (theoretical price **F** > market price **P**)
  - Buy the futures contract at the quoted market price (P)
  - Sell the underlying at the spot price
  - Invest or lend the money at the risk-free rate for the period until expiry

Example

- Elaine Pinto believes she has identified an arbitrage opportunity for a commodity and has gathered the following information.

- Commodity price and interest rate information:

Spot price for commodity	R100
Futures price for commodity expiring in 1 year	R120
One-year interest rate	6%

$$\begin{aligned} \textit{Theoretical price}(F) &= S(1+r)^t \\ &= 100(1.06)^1 \\ &= R106 \end{aligned}$$

- Action that will realise an arbitrage opportunity:
- The market price is greater than the theoretical futures price thus it is a cash and carry arbitrage.
- Sell futures, buy spot and borrow money.

Options

- In order to understand options very well you need to understand:
  - Options definitions and terminology: Options notation and variables.
  - Table 13.1

- **Call option:** [c = max(0; S – X)]
- Call holder(buyer) can exercise his right to purchase the underlying should the spot price exceed the exercise price (**S > X**).
- When S > X, the call option has an intrinsic value (in-the-money).
- When S = X, the call option is at-the-money.
- When S < X, the call option is out-the-money.

- **Put Option:** [p = max (0; X – S)]
- The put holder can exercise his right to sell the underlying should the exercise price exceed the spot price (**X > S**).
- When X > S, the put option has an intrinsic value(in-the-money).
- When X = S, the put option is at-the-money.
- When X< S, the put option is out-the-money.

Option Payoffs

Buying or selling a call option

- Break even = X + p
- Call holder:
  - Max profit = unlimited
  - Max loss = call premium (-p)
- Call writer:
  - Max profit = call premium (p)
  - Max loss = unlimited

Buying or selling a put option

- Break even = X – p
- Put holder:
  - Max profit = X – p
  - Max loss = put premium (-p)
- Put writer:
  - Max Profit = put premium (p)
  - Max loss = -(X – p)

Put-Call Parity

- A 6-month European call option with a strike price of R200.00 sells at a premium of R10.00. It has a risk-free rate of 8% and a current price of R201.00. Using the put-call parity, what is the equivalent value of the European put option.

$$S + p = c + X(1 + r)^{-t}$$

$$201 + p = 10 + 200(1.08)^{-0.5}$$

$$p = 10 + 192.4501 - 201$$

$$= R1.45$$

Option “Greeks” and Trading Strategies

- Ensure that you know:
  - The difference among the various options “Greeks”.
  - The definition of the various option trading strategies and be able to distinguish the characteristics of each of the option trading strategies.

Chapter 14

- **General portfolio construction**

Probability of occurrence	Rate of Return – Security P	Rate of Return – Security Q
20%	20%	14%
35%	15%	10%
45%	10%	6%

- Calculate the following:
  1. The standard deviation of both securities.
  2. The correlation coefficient between the two assets.
  3. The portfolio risk, if 40% of the portfolio is invested in P and 60% in Q.

Standard Deviation of the Assets

- Standard of deviation for both assets:

$$E_P = (0.20 \times 20) + (0.35 \times 15) + (0.45 \times 10)$$
$$= 13.75\%$$

$$E_Q = (0.20 \times 14) + (0.35 \times 10) + (0.45 \times 6)$$
$$= 9.00\%$$

$$\delta_P = \sqrt{0.20(20 - 13.75)^2 + 0.35(15 - 13.75)^2 + 0.45(10 - 13.75)^2}$$
$$= \sqrt{7.8125 + 0.5469 + 6.3281}$$
$$= \sqrt{14.6875}$$
$$= 3.83\%$$

$$\delta_Q = \sqrt{0.20(14 - 9)^2 + 0.35(10 - 9)^2 + 0.45(6 - 9)^2}$$
$$= \sqrt{5 + 0.35 + 4.05}$$
$$= \sqrt{9.40}$$
$$= 3.07\%$$

Correlation (Calculation)

- Correlation between both assets:

$$Correlation(r_{P,Q}) = \frac{Covariance_{P,Q}}{\delta_P \times \delta_Q}$$

$$Covariance_{P,Q} = [0.20(20 - 13.75)(14 - 9)] + [(0.35(15 - 13.75)(10 - 9)]$$

$$+ [0.45(10 - 13.75)(6 - 9)]$$

$$= 6.25 + 0.4375 + 5.0625$$

$$= 11.75$$

$$Correlation(r_{P,Q}) = \frac{11.75}{3.83 \times 3.07}$$

$$= 0.99$$

Portfolio Standard Deviation

- Portfolio standard deviation (δ_P):

$$\sigma_P = \sqrt{[W_P{}^2 \times \sigma_P{}^2] + [W_Q{}^2 \times \sigma_Q{}^2] + [2 \times W_P \times W_Q \times r_{P,Q} \times \sigma_P \times \sigma_Q]}$$

$$Where: W_P = 0.40 \qquad W_Q = 0.60 \qquad r_{P,Q} = 0.99 \qquad \delta_P = 3.83\% \qquad \delta_Q = 3.07\%$$

$$\delta_P = \sqrt{[0.40^2 \times 3.83^2] + [0.60^2 \times 3.07^2] + [2 \times 0.40 \times 0.60 \times 0.99 \times 3.83 \times 3.07]}$$

$$= \sqrt{2.347 + 3.393 + 5.5874}$$

$$= \sqrt{11.3274}$$

$$= 3.37\%$$

Chapter 15: Evaluation of Portfolio Management

Unit trust	Average rate of return	Variance	Beta
New Mutual	14	1.80	0.40
Invest	25	3.90	0.80
Grand Merchant	32	5.26	1.20
Total Market Index	12	1.50	

Assume the risk free rate of return is 8%.

1. Calculate the performance of New Mutual unit trust according to the method of Treynor.
2. Calculate the performance of Invest unit trust according to the method of Sharpe.
3. The performance of Grand Merchant unit trust according to the method of Jensen.

Performance measurement

$$Treynor_{New\ Mutual} = \frac{r_p - r_f}{\beta}$$

$$= \frac{14 - 8}{0.40}$$

$$= 15.00$$

$$Sharpe_{Invest} = \frac{r_p - r_f}{\delta_p}$$

$$= \frac{25 - 8}{\sqrt{3.90}}$$

$$= 8.61$$

$$Jensen's\ alpha(\propto)_{Grand\ Merchant} = r_p - [r_f + \beta(r_m - r_f)]$$

$$= 32 - [8 + 1.20(12 - 8)]$$

$$= 32 - 12.80$$

$$= 19.20\%$$

BEST OF WISHES IN YOUR EXAMS!