MA2001

LINEAR ALGEBRA I

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Outline of today's live lecture

I. Module information

II. About Linear Algebra

- This session will be recorded

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Your Lecturers

- Dr Victor Tan (VT)
- Office : Blk S17 #07-22
- Email: mattanv@nus.edu.sg

Webcast lectures
Live lectures (L2)

- Dr Jonathon Teo (JT)
- Office : Blk S17 #05-19
- Email: matjtyh@nus.edu.sg

Tutorial problems
Live lectures (L1)

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Lesson Plan

	OTOT before LL	Scheduled live (every Friday)	OTOT before next T	OTOT before deadline	Scheduled live (during tutorial)	OTOT before deadline	OTOT before next L
Wk	**Web lecture videos**	**Zoom lectures**	**Tutorial sets**	**Online Quizzes**	**Group discussion**	**Homework**	**Lab**
1		LL0 (intro)					
	Section 1.1-1.4	LL1 (up to 1.4)		Q1			L1
2	Section 1.4-1.5, 2.1-2.2	LL2 (up to 2.2)	T1	Q2			
3	Section 2.3-2.5	LL3 (up to 2.4)	T2	Q3	GD1		L2
4	Section 2.5, 3.1	LL4 (up to 3.1)	T3	Q4		HW1: up to 2.4	
5	Section 3.2-3.3	LL5 (up to 3.3)	T4	Q5	GD2		L3
6	Section 3.4-3.5	LL6 (up to 3.5)	T5	Q6			
7	Section 3.6-3.7	LL7 (up to 3.7)	T6	Q7	GD3	HW2: up to 3.5	L4
8	Section 4.1-4.3	LL8 (up to 4.3)	T7	Q8			
9	Section 5.1-5.2	LL9 (up to 5.2)	T8	Q9	GD4		L5
10	Section 5.3-5.4, 6.1	LL10 (up to 5.4)	T9	Q10		HW3: up to 5.2	
11	Section 6.2-6.3	LL11 (up to 6.3)	T10	Q11	GD5		L6
12	Section 7.1-7.2	LL12 (up to 7.2)	T11	Q12			
13		LL13 (revision)			GD6	HW4: up to 7.2	

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How to study for this module ?

LumiNUS Learning Flow

Weekly process (recommended)

1. View webcast lecture videos of the week
2. Attend the scheduled live Lecture
3. Attempt tutorial set of the week (starting week 2)

   (view the tutorial solutions video/attend tutorial sessions in the following week)
4. Attempt the online quiz of the week (before the deadline)
5. Go through lab worksheet (alternate weeks)
6. Attend group discussion (alternate weeks)
7. Attempt homework set (4 sets before deadline)

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Webcast lectures VS Live lectures

Web lectures (WL)

- Go through the main topics from chapter 1 to 7
- Follow the textbook closely
- More detailed explanations

Live lectures (LL)

- Supplement the WL
- Summarize topics of the week
- Additional examples
- Quizzes (not grades)
- Miscellaneous
- Interactive Q&A

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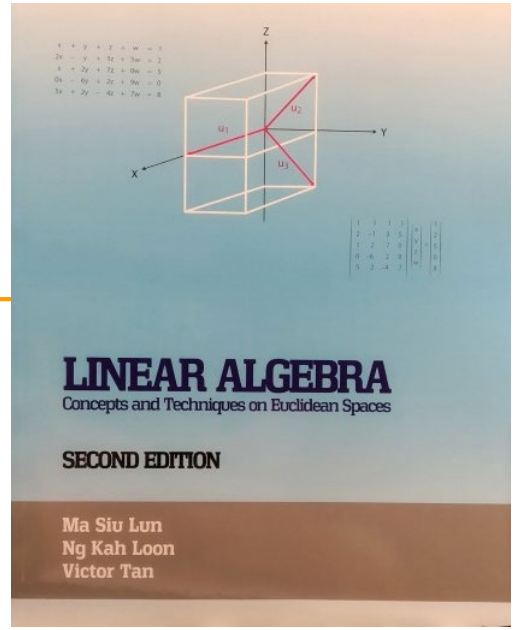
Tutorial sessions

- Every week starting from week 3
- Optional for week 4, 6, 8, 10, 12
- Compulsory for week 3, 5, 7, 9, 11, 13 (for group discussion)
- Tutor will discuss selected* tutorial problems from the tutorial sets from the past weeks
- Students may ask tutor to explain other not selected questions, subject to time limit.

* Complete tutorial solutions video clips will be available.

Textbook



- Linear Algebra: Concepts & Techniques on Euclidean Space
- by Ma S.L. , Ng K.L. & V. Tan
- Publisher: McGraw Hill (2nd Ed)
- Buy from NUS Coop online
- Borrow from NUS Library RBR/e-textbook (2-hr limit)
- Strongly encouraged to get one:
  - Chapters used as lecture notes
  - Exercise sets used for tutorial/self practice
- Not advisable to use older versions

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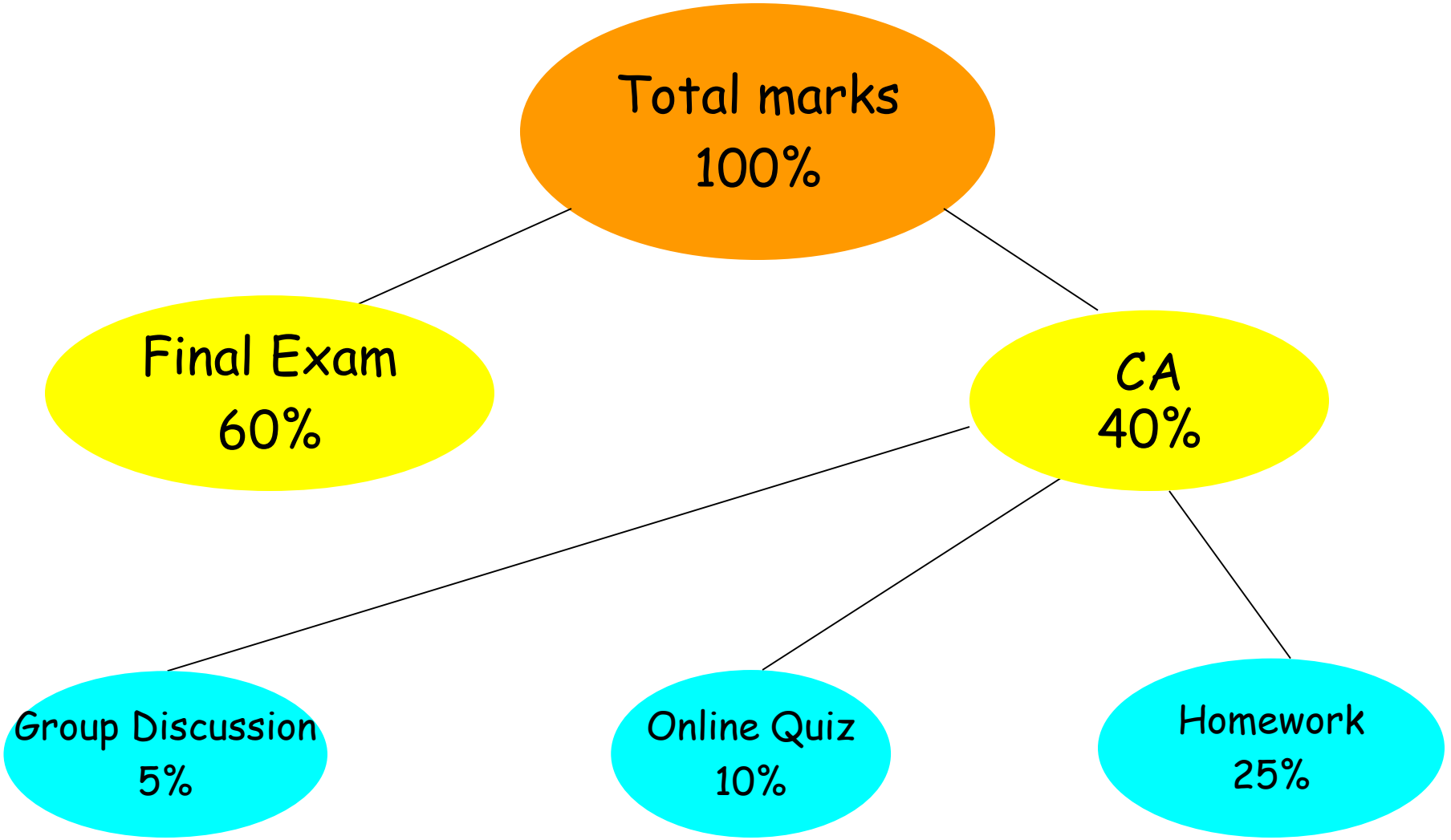
Assessments



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Final Exam

- Final examination 23rd Nov (1-3pm)
- Zoom proctored exam (2 hrs)
- Using Examplify (lockdown internet; local drive accessible)
- Hand written answers on paper; scanned and upload pdf to LumiNUS.
- More details later

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Group discussion

- 6 live zoom discussion sessions
- Conducted during tutorial sessions in week 3, 5, 7, 9, 11, 13
- Problem set will be available during the session
- Students will be divided into breakout rooms to discuss and solve the problems.
- No need to submit the answers.
- Mark awarded based on participation

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Homework

- 4 homework sets (HW)
- HW problems will be available in LumiNUS in week 2, 5, 8, 11.
- Submit softcopy of HW through LumiNUS in week 4, 7, 10, 13 (Friday)
- Answers can be written on paper and scanned as PDF, or written on ipad/tablet and submit directly.
- HW problems are different from tutorial problems
- Late submission will not be accepted without valid reason.

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Online Quizzes

- 12 online quizzes
- Available weekly in LumiNUS under Quiz
- Topics covered in webcast lecture of the week.
- Quiz 1 is opened. Due Aug 26.
- Quiz 2 - 12 open every Friday and close the following Thursday.
- You can submit as many times as you wish before the deadline.
- Only the last submission will be counted.
- View your scores and correct answers in LumiNUS after the quiz closed.

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Lab worksheet

- 6 lab worksheets to be gone through in week 1, 3, 5, 7, 9, 11.
- Download MATLAB software (free for NUS students)
- Install MATLAB in your PC* (instead of using the MATLAB Online)
- The worksheets are for self-practice. Familiarize yourself with the MATLAB commands.
- Students are allowed to use MATLAB during final exam.

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Important dates

- Final examination 23rd Nov (1-3pm)
- Online quizzes (weekly deadlines)
- Group discussion (conducted during tutorial slots in week 3, 5, 7, 9, 11)
- Homework (4 assignments to be submitted in week 4, 7, 10, 13 on Friday)

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Have a question about this module?

- Ask during live lectures/tutorial
- Email the lecturers
- Set up consultation session with the lecturers
- Post your question in LumiNUS forum

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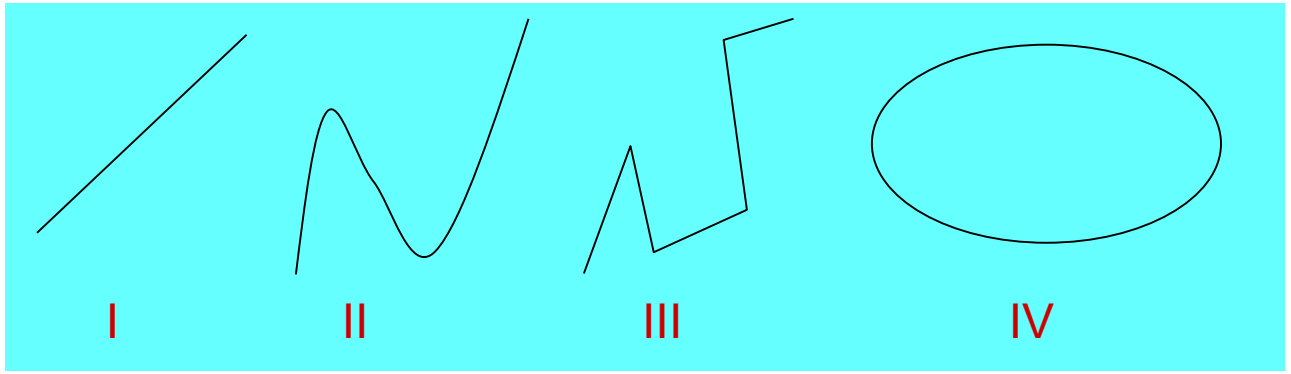
Quiz

Which of the following is a line?



A. All are lines
B. Only I, II, III are lines
C. Only I and II are lines
D. Only I is a line

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What is Linear Algebra?

having the properties of lines

1 dimensional linear object: line

2 dimensional linear object: plane

linear systems
vectors
matrices

The study of mathematical objects and properties that are related to
lines, planes and their generalization.

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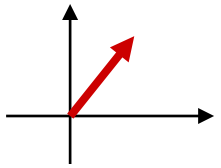
Vectors and Matrices

2-dim	$\begin{pmatrix}2\\4\end{pmatrix}$  arrow in xy-plane	$\begin{pmatrix}1&2\\5&3\end{pmatrix}$ transformation of a vector to another	algebraic expression geometrical representation
3-dim	$\begin{pmatrix}2\\4\\1\end{pmatrix}$ arrow in xyz-space	$\begin{pmatrix}1&2&6\\5&3&0\\4&7&1\end{pmatrix}$ transformation of a vector to another	algebraic geometrical
> 3-dim	$\begin{pmatrix}2\\4\\1\\7\end{pmatrix}$ none	$\begin{pmatrix}1&2&6&4\\5&3&0&8\\4&7&1&2\\0&0&9&1\end{pmatrix}$	algebraic geometrical

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Linear Systems

Linear system

2 equations

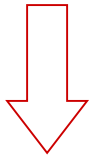
2 variables

$$\begin{array}{rcrcrcr} x & + & y & = & 1 \\ 2x & + & 3y & = & 2 \end{array}$$

represents 2 lines

solution: $x = 1, y = 0$ intersection of the 2 lines

algebraic generalization



Linear system

5 equations

4 variables

$$\begin{array}{rcrcrcrcr} x & + & y & + & z & + & w & = & 1 \\ 2x & - & y & + & 3z & + & 5w & = & 2 \\ x & + & 2y & + & 7z & + & 0w & = & 5 \\ 0x & - & 6y & + & 2z & + & 9w & = & 0 \\ 5x & + & 2y & - & 4z & + & 7w & = & 8 \end{array}$$

How to find the solutions?

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Linear Systems – Different Expressions

$$\begin{array}{rcrcrcrcl} x & + & y & + & z & + & w & = & 1 \\ 2x & - & y & + & 3z & + & 5w & = & 2 \\ x & + & 2y & + & 7z & + & 0w & = & 5 \\ 0x & - & 6y & + & 2z & + & 9w & = & 0 \\ 5x & + & 2y & - & 4z & + & 7w & = & 8 \end{array}$$

standard form

$$\begin{pmatrix} 1 & 1 & 1 & 1 \\ 2 & -1 & 3 & 5 \\ 1 & 2 & 7 & 0 \\ 0 & -6 & 2 & 9 \\ 5 & 2 & -4 & 7 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ w \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 5 \\ 0 \\ 8 \end{pmatrix}$$

matrix equation form

$$x \begin{pmatrix} 1 \\ 2 \\ 1 \\ 0 \\ 5 \end{pmatrix} + y \begin{pmatrix} 1 \\ -1 \\ 2 \\ -6 \\ 2 \end{pmatrix} + z \begin{pmatrix} 1 \\ 3 \\ 7 \\ 2 \\ -4 \end{pmatrix} + w \begin{pmatrix} 1 \\ 5 \\ 0 \\ 9 \\ 7 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 5 \\ 0 \\ 8 \end{pmatrix}$$

vector equation form