28th SEP MONDAY WK1
2015

Jed Gibbs
for
Charlton Rodd

3pm. FOUNDATIONS OF COMPUTER SCIENCE
Lectures 1 & 2
Introduction to Linear Algebra
Maria Polukarov
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http://www.ecs.soton.ac.uk/mp3
also Pavel

May be most challenging module
weekly extra help by postgraduates. ASK if in trouble.
2 hour slot / week - possibly Wednesday afternoons (but conflicts with sport).

Also lecturers have office hours.
Assessments:
5 class tests during semester @ 5%
weeks 2, 4, 7, 9, 11 on Thursdays total 25%
more info next week.

+ 2 hour exam worth 75%

LECTURES

- Slides will be available a couple of days before lecture. • Read through them AND the recommended reading
- There will be more content in the lectures using white board etc.

secure.ecs.soton.ac.uk/notes/comp1215

tutorial sheets in advance. Try on your own and then some will be gone through in class.

FIRST TOPIC - LINEAR ALGEBRA

get from library?

A.G. Hamilton linear algebra, an intro with concurrent

S. Axler Linear Algebra done right.

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<u>example from white board</u>

man runs 0.2

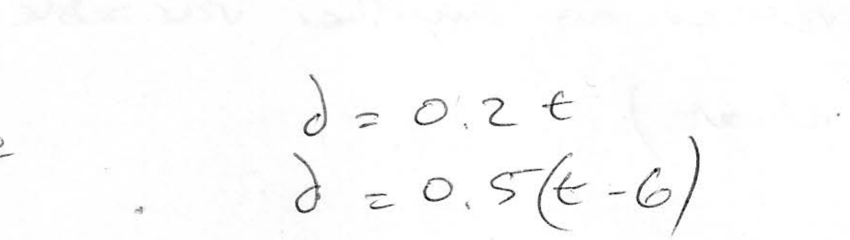
horse runs 0.5 but must be saddled for 6 minutes.

how far can the ~~st~~ man get before he is caught?

t - time

d - distance

$$d = 0.2t$$
$$d = 0.5(t-6)$$



Solve the following simultaneous equations

$$x + 3y = 1 - x$$
$$x - y = 4 + y$$

substitute
$$2x + 3y = 1$$
$$x = (4 + 2y)$$

so

$$2(4 + 2y) + 3y = 1$$
$$7y = -7$$
$$y = -1$$
$$x = 2$$

subsitiom - find a variable that can be expressed as another variable + solve (as above)

linear equations all the variables are of degree 1

but not $2x + y^2 = 10$
that is a quadratic equation

A solution is an assignment to the variables that makes both sides agree

$$x + y = 1$$
$$2x + 2y = 2$$

To solve a system of simultaneous equations is to solve all possible - none, one, or more.
4.4. (no solution to parallel lines)

Gaussian Elimination

wk 1

An algorithm for solving simultaneous linear equations

Given 'n' equations with 'n' variables $x1, x2 \dots xn$; eliminate 1 of the variables $n-1$ equations with $n-1$ variations

1. divide first eqn. through coefficient of x_1

example Hamilton (see slide)

$$2x_1 - x_2 + 3x_3 = 1 \quad (1)$$

$$4x_1 + 2y_2 - X_3 = -8 \quad (2)$$

$$3x_1 + x_2 + 2x_3 = -1 \quad (3)$$

① $x_1 - \frac{1}{2}x_2 + \frac{3}{2}x_3 = \frac{1}{2}$ $\quad (1) \div 2 \rightarrow (1)$

② $4x_2 - 7x_3 = -10$ $\quad (2) - 4 \times (1) \rightarrow (2)$

$\frac{5}{2}x_2 - \frac{5}{2}X_3 = -\frac{5}{2}$ $\quad (3)\ 3 \times 1 \rightarrow (3)$

③ $x_2 - \frac{7}{4}X3 = -\frac{5}{2}$ $\quad (2) \div 4 \rightarrow (2)$

④ $\left(-\frac{5}{2}X_3 + \frac{7}{4} \cdot \frac{5}{2}X_3\right.$ $\quad (3) - \frac{5}{2} \times (2) \rightarrow (3)$

$\boxed{4.5}$

$$\frac{15}{8}x_3 =$$

$$\left(\left(-\frac{5}{2} + \frac{25}{4}\right)\right).$$

$$\frac{15}{8}x_3 = \frac{15}{4} \quad (3) - \frac{5}{2} \times (2) \rightarrow (3)$$

$$x_3 = 2 \rightarrow (2)$$

$$x_2 - \frac{7}{4} \cdot 2 = -\frac{5}{2}$$

$$x_2 = -\frac{5}{2} + \frac{7}{2} = 1$$

$$\boxed{x_2 = 1}$$ substitute into equation 1

$$x_1 = \frac{1}{2} + \frac{1}{2} - 3 = -2$$

$$x_1 = -2$$