Classical Mechanics

Phys105A, Winter 2007

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The Final

- Wednesday, March 21, 8:00–11:00, Broida 1640
  Arrive on time (that is, *before* 8 o’clock)

- Material: all chapters 1–7, with an emphasis on 5–7.

- Set-up the same as with Midterm: no book,
  no electronics, 2 sided cheat sheet allowed.

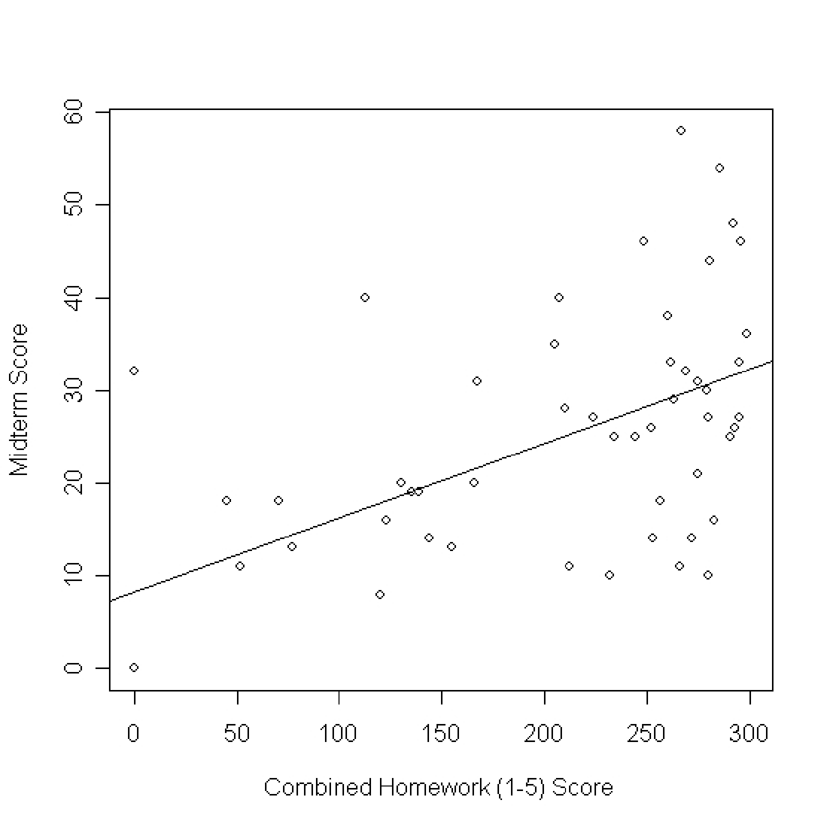
- Please email me to arrange office visits.

Midterm vs Homework

Linear regression analysis gives the HW1–5 versus Midterm predictor as

$MT = 8.25 + 0.08\ HW$

with p-value $\sim 10^{-5}$.



Average MT was 26 (±12), hence normalized we get

$m = -1.48 + 2h$

with $0 \le h \le 1$ the percentage of your homework scores and m your normalized midterm score (0=average, 1=stdev).

The Final Grade

The grade distribution will be approximately:
20% A, 50% B, 30% C+D+F; median/mean = B–.

The final score is 40% HW + 20% MT + 40% F,
where the scores are the *normalized scores:*

$$\text{HW} = \frac{\text{your HW points} - \text{average HW points}}{\text{stdev HW points}}$$

similarly for MT and F

average (±stdev) for HW 1–5: 216 (±80)
average (±stdev) for MT: 26 (±12)

Where Do I Stand?

You have to make an assumption about how well you will do on the Final; let's say similarly as on the Midterm…

$$\text{est} = 0.4 \times \frac{\text{your HW1-5 points} - 216}{80} + 0.6 \times \frac{\text{your MT points} - 26}{12}$$

At the moment, this estimate translates into:

A: $+0.6 \leq \text{est} \leq +1.9$

B: $-0.6 \leq \text{est} \leq +0.6$

C: $-1.0 \leq \text{est} \leq -0.6$

D+F: $-1.6 \leq \text{est} \leq -1$

Q&A

- Questions?

- Any comments regarding the Midterm?

Proposed method of preparing:
Try to answer a * problem without notes.
Make a cheat sheet with the notes that had to look up
Do this for every chapter
Repeat as necessary, keep updating your cheat sheet
Repeat for ** questions

Problems vs Final

No notes and electronics are allowed, so…
  You should not worry to much about complicated integrals or calculations that would require a computer or detailed notes, or a lot of time.

If you are facing a difficult looking calculation, odds are:
  There is a ‘trick’ that simplifies matters
  You are approaching the problem the wrong way

Note that you will not know from which specific chapter the problem comes.

7: Lagrange

- You should be able to: write down the Lagrangian of a described system; solve the system using L’s equations; understand what goes on.
- Look at the examples
- Problems: 7.8; 7.11; 7.14; 7.27

6: Variations

- You should be able to: translate an optimization problem into a set of Euler-Lagrange equations; solve a system of such equations
- Try to understand the brachistochrone problem
- Problems: 6.3; 6.15; 6.20

5: Oscillations

- You should be able to: understand qualitatively what goes on with damped and driven oscillations; be familiar with the terms/concepts involved; solve the linear differential equations (using the operator D).
- Problems: 5.2; 5.9; 5.17; 5.26; 5.30

4: Energy

- You should (be able to): understand the interaction between work and kinetic energy, understand the concept of conservative forces and potential energy, know the mathematics behind $\mathbf{F} = -\nabla U$ and $\nabla\times\mathbf{F}=\mathbf{0}$ in different coordinate systems, reason about 1d systems, able to solve problems using conservation of energy and/or conservation of (angular) momentum where Chapter 1 methods fail (cf. Midterm question)

- Problems: 4.8; 4.19; 4.23; 4.28; 4.32; 4.36; 4.41; 4.52

3: Momentum

- You should (be able to): see the advantage of summarizing quantities like center of mass and total (angular) momentum, understand why conservation of momentum holds, understand the similarities and differences between linear and angular momentum, skilled in using mathematical niceties such as “$a \times a = 0$” and “$a \cdot b = 0$ if and only if a and b are perpendicular”.

1+2: Newton and Projectiles

- You should be able to: know how to set up the equation of motion of a described system, understand qualitatively what goes on, deal with systems that have drag and/or magnetic force

- Mathematical skills involved: vector notation, linear algebra in R^3, products of vectors, solving simple differential equations, using Cartesian, polar (cylindrical) and spherical coordinate systems, method of separation of variables, limits, using complex variables to model movement in 2d systems