

IC-101: INTRODUCTION TO IMPERIAL

(With apologies to R. J. Yeatman and W.C. Sellar)

This paper has questions on a number of topics with which those working and studying at Imperial are expected to be familiar. Answer ALL questions. Those scoring less than 40% are advised they will be recommended for Universities UK membership of the Joint Negotiating Committee of the Universities Superannuation Scheme.

Note: the examiners place great emphasis on clarity and transparency: PLEASE SHOW ALL WORKING.

1. (Arithmetic) A Pension Scheme has an estimated deficit of £6bn. In 1997, the employers decreased their pension contribution from 18.55% to 14%. Had they not done so, there would be another £7bn in the pension fund. Estimate the pension deficit assuming the universities had maintained their contributions, and comment on the deficit origin. [10]
2. (Practical Skills, Health and Safety) A universities' pension consultation document states: "...younger employees are choosing different working patterns and practices to their older colleagues and this raises the question of whether the current DB schemes remain appropriate for the needs of all employees."
 - a) Find a sample of postdocs who do not know whether they will have a job in a years time; [1]
 - b) Inform them that they are practicing a working pattern of their own choice. [9]

WARNING: this experiment may be dangerous, and there is a significant risk of personal injury. Ensure you wear personal protective equipment while conducting it.
3. (Arithmetic) A university employs 30 people on salaries over £200,000 and 6 people on salaries over £300,000. What is the lowest estimate of the combined salary of these 36 individuals? [10]
4. (Finance) The same university rejects a proposal to increase their contributions by an additional £10m a year to prevent a loss in the value of their pensions. The university has not presented any concrete alternative proposals on how to compensate staff. Suggest a quantifiable solution for the university. [10]
5. (Information theory) Compare the number of units of information contained in the following two passages. [10]
 - a) USS members have been asking for more detailed information about how the proposed changes to the USS would impact them personally. The USS will shortly be releasing an online modeller as part of their official consultation process—we will notify staff when this is available and provide advice on how to use it.
 - b) We have no clue how our proposals are going to affect staff.
6. (Medical Diagnosis) A patient describes their condition thus: "We are acutely aware that in order to recruit, develop and retain world-class academic staff we need to offer an attractive package of benefits." Describe the symptoms of acute awareness and outline a basic treatment. [10]

7. (Calculus) A university whose staff have gone on strike employs M senior managers.
- Find the minimum number of strike days x required for the M managers to discover that they work in an institution that prides itself on evidence-based analysis. [5]
 - The same university has the total number of staff S . What is the minimum layers of management required for M to become oblivious to the needs of S ? [5]
8. (Combinatorics) A university decides to split the job done by a single person (e. g. Rector) between two people (e. g. President and Provost)
- how many additional meetings will these two people have to attend to fill their working day? [3]
 - assuming these meetings are attended on average by four people, how many additional senior-management posts will have to be created? [3]
 - using your answer to question 3, estimate the resulting increase in the university's overheads. [4]
9. (Politics) Staff at a UK university go on strike. The university management need to suggest they are listening to the concerns of their staff.
- Describe how this suggestion might be advanced by organising a meeting with Heads of Departments on a strike day. [5]
 - Identify any selection bias of which the management should be aware in following this suggestion. [5]
10. (Finance and Asset Management) A meteorite shower is about to strike the universities across the UK.
- Argue why a prudent pension-fund manager will de-risk the situation by transferring fund assets into secure government bonds. [5]
 - Describe potential mitigation of the risk to the fund if the meteorite shower hits during working hours . [5]