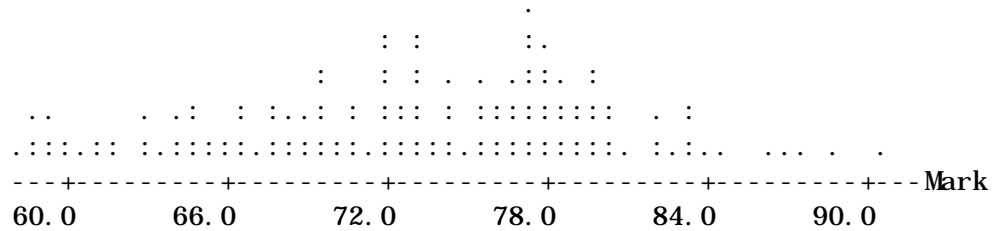


Instructions: The test is open book – use any notes or books. Answer all questions. You have approximately 45 minutes to earn the 45 marks. Keep your answers brief in order to complete the test. Point form is OK as long as it is understandable.

1. (10=5+5 marks)

- a) Without doing any calculations, estimate the mean and SD of the 150 marks displayed in the dotplot below:
- b) From the dotplot, find the 10<sup>th</sup> percentile. Describe how you arrive at your answer.



ANS 1.

- a) mean is 73, SD is about 7.5 marks if within +-2, 2 marks if only within 3.
- b) 10<sup>th</sup> percentile is the one 15 from the bottom, which is at 63.0.

2. (10=5+5 marks) It is often suggested that the stock market indexes exhibit the behaviour of a “symmetric” random walk (a cumulation of step sizes of +1 or –1 with the probability of each being 0.5.).

- a) If this were true, what difficulty would it present to investors?
- b) What property of the symmetric random walk warns us about trying to predict the future of the stock market indexes based on past trends?

ANS 2.

- a) Can't tell if market going up or down in future, so don't know when to buy and when to sell.
- b) The symmetric random walk exhibits apparent long-run trends even though this model guarantees that such trends will not persist. This may also be true of the stock market suggesting that past trends cannot be relied upon to predict the future.

3. (10 marks)

In class we did an example in which an auto insurance policy cost \$1825 per year and the average cost to the insurance company of one or more accidents for a policy-holder was \$6000. We found that if accidents occurred with 20% of the policy-holders, and if there were 200 or more policy holders, the insurance company was very likely to make a profit. However, for any one policy holder, the gain could be 1825 but a net loss of \$6000-\$1825 = \$4175 was almost certain for at least a few policy-holders. How does the square root law for the variability of averages explain why the insurance company is likely to be profitable in spite of the risk of big losses on individual policies? (Hint: Think of the return on each policy as being equally likely to be 1825, 1825, 1825, 1825, or –4175. )

ANS 3. The SD of the average of gross profits from the 200 policies will be less than the SD of the gross profit from a single policy by a factor of  $\sqrt{200}$  (= approx 14.) The mean gross profit is \$625 (Just by averaging the 5 numbers in the hint) and the SD is 2400 and  $2400/14 = \text{approx } 170$ , it is very unlikely that the average would be less than 0.

4. (15= 5+5+5 marks)

- a) In the Health Insurance study (pp 31-40), what was the purpose of random allocation of treatments to subjects?
- b) What was the non-experimental strategy proposed for the Salk Vaccine study? (pp3-14).
- c) The Test Scores article (pp 178-187) describes a method of adjusting student scores. Why was adjustment necessary?

ANS 4.

- a) So the groups with different deductibles would be comparable with respect to characteristics other than the deductible.
- b) To compare grades 1 and 3 (controls-no vaccine) with grade 2 (vaccine).
- c) Many readers were required to mark the huge number of essays, and it was known that some readers would give higher marks for similar essays than other readers. So the adjustment was to make the marks fairer.

(KLW 021009)