

1. The 23 numbers given below are a sample of some feature of a system variable, which we shall denote by X . The sample is presented in sorted format. **20**

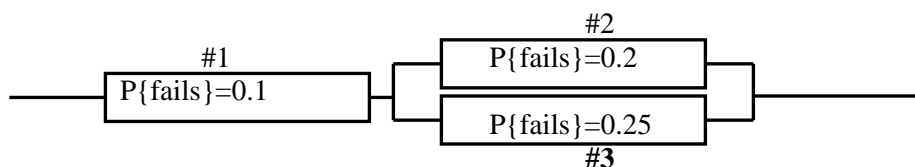
3 5 5 6 7 8 11 12 12 16 19 21 24 26 26
28 30 31 34 36 40 41 43

- Find the sample median for the data.
- If we change the last value from 43 to 55, what would happen to the sample mean?
- If we change the first value from 3 to 0 and the last value from 43 to 75 what would happen to the sample variance? Answer qualitatively.
- For b. and c. what would happen to the median and the IQR? Answer qualitatively.

For b. c. and d. DO NOT find the mean and variance, just explain your answer qualitatively. If you actually compute the mean and variance points will be deducted.

2. The number of packets per message is modeled by the geometric distribution with an average length that depends on the type of message. The average length of data messages is 2 packets, and the average length of voice messages is 5 packets. 30% of all messages are voice messages.
NOTE: A message is either voice or data – it is NOT both at the same time.
HINT: Average length determines the value of p that defines the geometric pmf.
- Find the probability that a message contains exactly 4 packets. **15**
 - If we know that a message contains exactly 4 packets, what is the probability that it is a voice message? **10**
 - What is the average length of a message? **10**
3. The number of breakdowns in a network may be modeled as satisfying the Poisson model with arrival rate of λ per second. The rate depends on whether congestion condition exists at the time. Under congestion condition, which we shall denote by A , the rate is 0.01 per second, while under normal condition, which we shall denote as A^c , the rate is 0.001 per seconds. Heavy congestion is assumed to occur during 40% of the time, but we assume that in any given interval of less than five minutes **only one** of the conditions can exist (either A or A^c).
- During a 2-minute interval under congestion condition, find the probability that no breakdown occur. **10**
 - During an arbitrary 2-minute interval what is the probability that no breakdown occurs? **10**
 - Given that no breakdown occurred during a 2-minute interval, what is the conditional probability that there was a congestion condition? **05**
4. A system is composed of three links as shown. The failure probability of each link is shown in each box. Assume that each link fails independently of each other.

Find the failure probability of the system. **20**



The number in bold at the right of each question are the points assigned to the question.