

Your name: SOLUTIONS

**Quiz rules:**

- This quiz is closed book, but you are allowed a single page (both sides) of notes and a calculator.
- There are 6 questions, worth 6 points each.
- A normal table is provided on the last page.
- You have 50 minutes to complete this quiz.
- If you fail to show work and/or explain how you arrived at your answer then no points will be awarded.
- You do not need to solve all the problems to do well! So relax and try your best.

1. (a) Calculate the SD of the 5 numbers [0, 0, 1, 1, 1].

$$\text{Average} = \frac{3}{5} = 0.6$$

$$\text{Deviations} = [-0.6, -0.6, 0.4, 0.4, 0.4]$$

$$\begin{aligned}\text{SD} &= \text{RMS (Deviations)} = \sqrt{(2 \times (0.6)^2 + 3 \times (0.4)^2) / 5} \\ &= \sqrt{1.2 / 5} = \sqrt{0.24} = 0.49\end{aligned}$$

- (b) Using your answer to part (a), what is the SD of the 10 numbers [0, 0, 0, 0, 1, 1, 1, 1, 1]? Explain without doing the calculation.

$$\text{SD} = 0.49$$

The list of deviations is just 2 copies of other deviations.  
Therefore, r.m.s (new deviations) = r.m.s. (other deviations)  $\approx 0.49$

- (c) Using your answer to part (a), what is the SD of the 5 numbers [-1, -1, 9, 9, 9]? Explain without doing the calculation.

$$\text{SD} = 4.9$$

This new list is (old list  $\times 10 - 1$ ) entrywise.

$$\text{So, the SD (new list)} = 10 \times \text{SD (old list)}$$

2. Mary has two cats that weigh 5 lbs and 13 lbs. She plans to buy a third cat.

- (a) What is the largest the median could be for the weights of the three cats?

13 lbs. Because for any <sup>number</sup> larger than 13, the middle number of the sorted list would still be 13.

- (b) What is the smallest the average could be for the weights of the three cats?

6 lbs. The smallest a cat could weigh is 0 lbs.

This would make the average  $\frac{13+5+0}{3} = \frac{18}{3} = 6$  lbs.  
(Though it is unlikely to have cat weigh 0 lbs).

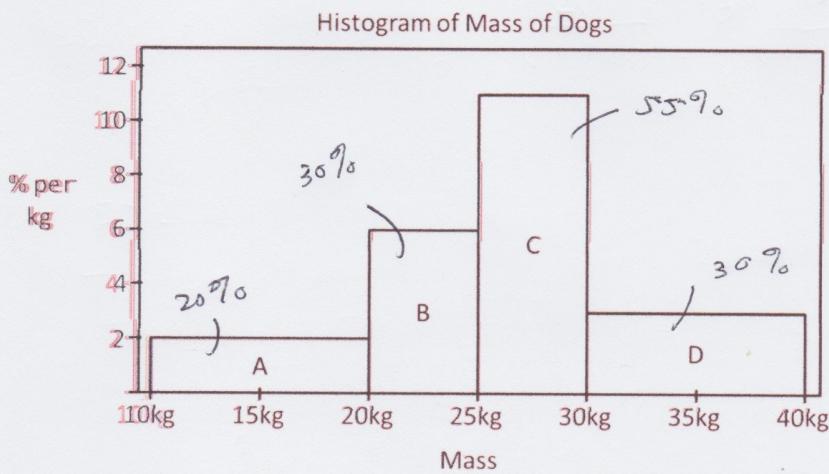
- (c) After buying the third cat, she is surprised to find that the median of the three weights is equal to the average. What are all the possible weights of the third cat?

The median has to be one of 5, 13 or the new cat's weight. It can't be 5, so it is either 8, 13 or the new cat.

This means the new cat is either 21 lbs (median = 13, average = 13)

or 9 lbs (median = 9 lbs, average = 9 lbs)

3. The local veterinary office recorded the mass of dogs they treated in the last six months. To summarize the mass, they produced the histogram below. Unfortunately, something is wrong with this histogram. Propose a change to exactly one of the blocks, leaving the other three unchanged.

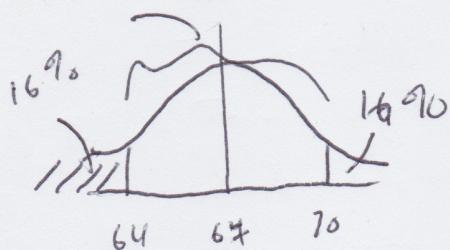


If we only change one block/bar, it has to be the one with  $55\%$  = C because even if we set any other block to 0 the total percentage is more than  $100\%$ .

So, we have to change the height of C to 4, making the area of C  $20\%$ .

4. The histogram of the heights of a class of 200 students is shaped approximately normal with an average height of 67 inches. You're told that 168 of the students are 64 inches or taller. For this class, what height would you anticipate the 95th percentile is?

$68\%$  We know  $16\%$  percentile is about 64 inches.



This tells us SD is roughly 3 inches (by  $68\%$  rule of thumb).

The 95th percentile is about 1.65 SDs above the average (from table).

$$\text{So, } 95\%-ile \approx (67 + 1.65 \times 3) \text{ in}$$

$$\approx 72 \text{ in}$$

5. SAT scores follow the normal curve with average 1500 and SD 300.

- (a) Bob scored in the 25th percentile but would like to get to the 75th percentile. Peter scored in the 15th percentile and would like to get to the 65th percentile. Who requires the greater improvement in score? Or do they require the same improvement?

From  
normal  
table

%	90-10
15	-1.05
65	0.37
25	-0.65
75	0.65

$$\text{Bob needs } [(0.65) - (-0.65)] \times 300 \approx 1.3 \times 300 \approx 390 \text{ points}$$

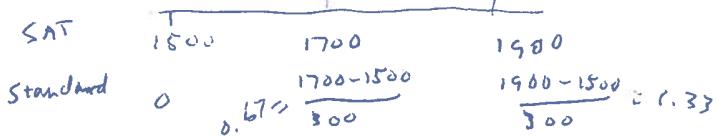
$$\text{Peter needs } [0.37 - (-1.05)] \times 300 \approx 1.4 \times 300 \approx 420 \text{ points}$$

Peter needs bigger improvement.

- (b) The SAT reports each student's score as a range: score  $\pm$  100. What percentage of students will have a score range that includes 1800? Explain carefully.

Their range includes 1800 if their score is between

1700 & 1900.



From table  $\approx$

$$(91 - 75)\% \approx 16\%$$

6. The histogram of GPAs at Stanford is shown below.

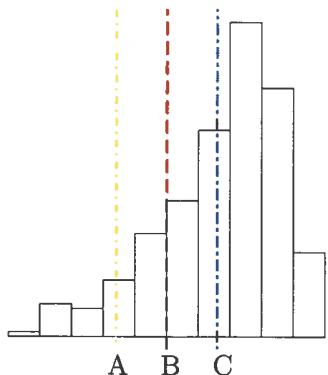
- (a) What percent of students have an above average GPA?  
Circle one and explain.

less than 50%

more than 50%

about 50%

Histogram is skewed left, so average will be less than median. And, more than 50% area to the right of average...



- (b) Which one of the three lines (A, B, or C) corresponds to the average GPA? Explain.

The average has to be bigger than B because there are 5 bars on either side of B, with all bars on the right higher than on the left. So, there is more weight to the right of B than to the left.

The average is C