

**Math 102 / Core 143 — Exam I**

Show all work clearly for partial credit — an unevaluated expression is worth more than the numerical answer.

1. (20 points) For the following list of numbers,

10, 17, 17, 18, 20, 21, 22, 22, 23, 25

find the:

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|--|--|
| <p>(a) average,</p> <p>(c) 90-th percentile, and</p> | <p>(b) standard deviation,</p> <p>(d) interquartile range (IQR).</p> |
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2. (8 points) For the list of ages of people (students, faculty and staff) at Colgate, which is likely to be larger: the average, the median or neither? Explain briefly.
3. (10 points) The heights of Adirondack peaks are recorded in feet above sea level. It is found that they average 3000 feet, with an SD of 600 feet. Then it is decided to record their heights in yards above the “ground base” of 1200 feet. What are the average and SD of the new heights, in yards?
4. (12 points) The scores on a (difficult — not like this one) stats exam follow a normal curve, with an average of 60 and an SD of 10.
- (a) Suppose we are told to guess a student’s score, knowing nothing else about him. What should we guess?
- (b) About two-thirds of the time, our guess in (a) will be within how much of the correct amount?
- (c) What is the 40-th percentile of the scores?
5. (6 points) Sketch two scatter diagrams, one illustrating a correlation coefficient of about 0.9 and the other illustrating a correlation coefficient of about  $-0.4$ .
6. (12 points) Short answers:
- (a) The experimental treatment for Parkinson’s disease involved (possibly “sham”) surgery on what part of the body?
- (b) From what (general class of) disease did Stephen Jay Gould (“The Median Isn’t the Message”) suffer?
- (c) Murray and Herrnstein assert that a person’s intelligence is associated to his/her \_\_\_\_\_, but note that this does not imply that intelligence has a genetic basis (the Iowa/Mojave analogy).
- (d) Lipschütz-Yevich says that Murray and Herrnstein’s conclusions cannot result in the histogram shape they use, the \_\_\_\_\_.

7. (12 points) In a group of several colleges, the percentages of male and female students who live off campus are noted.
- (a) Suppose in each college a lower percentage of men than women live off campus. Can we conclude that a lower percentage of the men of all the colleges together live off campus than women? Explain briefly.
  - (b) Suppose in each college 40% of the men and 60% of the women live off campus. Can we conclude that 40% of the men and 60% of the women at all the colleges together live off campus? Explain briefly.
8. (20 points) Design a simple experiment to see whether new drug A is more effective than old drug B in controlling sneezing in cold sufferers. Explain how your design embodies the principles of a good experiment as described in Part One of the text.
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Some Possibly Useful Formulas:

$$\sqrt{\text{Average of } (x - AV_x)^2}$$

$$(\sqrt{1 - r^2}) (SD_y)$$

$$\text{Average of } [(x \text{ in std units}) \cdot (y \text{ in std units})]$$

### Math 102 / Core 143 — Solutions to Exam I

1. (a) Average =  $(10 + 17 + 17 + 18 + 20 + 21 + 22 + 22 + 23 + 25)/10 = 19.5$ .  
(b) Standard Deviation =  $\sqrt{((9.5)^2 + 4(2.5)^2 + 2(1.5)^2 + (0.5)^2 + (3.5)^2 + (5.5)^2)/10} = \sqrt{162.5/10} \approx 4.03$ .  
(c) 90-th percentile = 23.  
(d) IQR =  $22 - 17 = 5$ .
2. The average is higher, because the ages of the faculty and staff will form a tail (skew) to the right, pulling the average up more than it affects the median.
3. Since we get the new heights by subtracting 1200 from each height and then dividing by 3 (feet per yard), the new average is  $(3000 - 1200)/3 = 600$  yards, and the new SD is  $600/3 = 200$  yards.
4. (a) 60  
(b) 10  
(c) We look for an area of  $100 - 2(40) = 20$  in the normal table, and find that it corresponds to a  $z$ -value of about .25; we take the negative, since the percentile is less than the 50-th, and then compute the corresponding exam score:  $-.25(10) + 60 = 57.5$ .
5. For 0.9, a long, thin cloud sloping upward; for  $-0.4$ , a fat, round cloud with a downward slope.
6. (a) skull (brain, head)      (b) cancer      (c) race      (d) bell (normal) curve
7. (a) No: Simpson's paradox may apply here.  
(b) Yes: Suppose the number of men at College 1 is  $m_1$ , say, the number at College 2 is  $m_2$ , etc. Then the number of men living off campus is  $.4m_1 + .4m_2 + \cdots = .4(m_1 + m_2 + \cdots)$ . Similarly for the women.
8. Take a group of cold sufferers, divide them (by a coin flip — random assignment to groups) into two groups, give one (the experimental group) Drug A and the other (the control group) Drug B. Make sure neither the patient nor the doctor administering the drug and caring for the patient knows which drug is being administered (run double-blind).