Math 102 / Core 143 — Solutions to Exam I

1. (a) $(6(1) + 3(2) + 18)/(6 + 3 + 1) = 3$

   (b) $\sqrt{(6(1-3)^2 + 3(2-3)^2 + (18-3)^2)/10} \approx 5.02$

   (c) 1, because over half the values are less than or equal to it.

   (d) Also 1.

   (e) $2 - 1 = 1$

2. (a) (iii) — No jersey number is used more than once.

   (b) (ii) — The Big Brothers/Sisters have heights in the right high point, the Little Brothers/Sisters in the left one (though that one should really be broader and lower, because there is probably more variability in the children's heights).

   (c) (i) — Most men have a few shirts, where "few" can cover a broad range, say 10 to 30. But a few men have many more.

   (d) (iv) — Exam scores are usually between 70 and 90, with a few at the extremes. But there is less room for a right tail than for a left one, because scores cannot exceed 100%.

3. (a) 0 — There is no reason to assume an association between birthday and IQ.

   (b) $-.5$ — More time spent on TV leaves less time for reading; but the correlation is far from perfect, because there are so many other things on which time could be spent.

   (c) 1 — Except for small roundoff errors, the two measurements should give identical lists of numbers in standard units.

4. (a) 120 mmHg — guess the average.

   (b) The standard deviation of pressure, 15 mmHg.

   (c) Because his dosage is $(60 - 40)/20 = 1$ standard deviation above average, we project his blood pressure as $0.8(1)$ standard deviation above average: $120 + (0.8)(15) = 132$ mmHg.

   (d) Because his blood pressure is $(110 - 120)/15 = -2/3$ standard deviation above average (i.e., two-thirds of a standard deviation below average), we project his dosage as $0.8(-2/3)$ standard deviations above average, i.e., $40 + (0.8)(-2/3)(20) \approx 29.3$ mg.

   (e) The RMS error for regression: $20\sqrt{1 - (0.8)^2} = 12$ mg.

5. (a) This need not be true. Depending on the relative sizes of the classes and the numbers of boys and girls in each, Simpson's paradox may apply, giving a different result.
   (b) This must be true: Even a weighted average must lie between the highest and lowest of the values being averaged.

6. It is difficult to get funding for clinical research on human subjects, as compared to more "original" research on animals. The two reasons given in the article are: (1) Scientists who conduct original research on animals think that clinical studies on humans, which must be based on earlier studies on animals, are not "innovative enough" to receive funding. (2) "Internal review boards," who review research on human subjects at various universities and other institutions, are often so concerned about ill treatment of the subjects (despite Begley's opinion that they should expect some rough going as human lab rats), that the research is often limited or blocked. Knowing this, reviewers for external funding agencies often give lower ratings to proposals for research on humans, so that such research does not receive funding.