Practice Readiness Assurance Test

Quantitative Reasoning, 22 October 2020

*Note that this week's RAT contains review of for loops and distributions, as these ideas will be useful for Thursday and beyond.

1. Exercise 5 on page 313 of the textbook.

2. Professor Q teaches Reasoning Quantitatively on Mondays and Wednesdays from 8am to 10am. 120 students have registered. She wants to run a survey on how the class is going, but she does not want to use a single minute of class time for the survey. Hence, she distributes the short survey at 7:55 and collects it back at 8am sharp. Since she only has 10 copies with her, she decides to randomly select a row (using R), and distributes the surveys to every student in that row and the preceding ones until she runs out. Which of the following statements is true?

    a. This is a simple random sample because it randomised the choice of row.
    b. This is a simple random sample because every student has an equal opportunity to sit in any seat.
    c. This is a voluntary response sample and is likely prone to voluntary response bias.
    d. This is likely to be a biased sampling scheme, weighting some students over others.

3. Which of the following should we expect to most closely resemble a normal distribution?

    a. The age of Singaporean women.
    b. The height of Singaporean buildings.
    c. The weight of Singaporean men.
    d. The last two digits of Singaporean phone numbers.

4. Suppose you run the following code.

```
count <- 0
vector <- c(1, 3, 5)
for (i in vector) {
      count <- count + 1
}
```

   What does `count` contain?

a. 3
b. 5
c. 1, 3, 5
d. 0

5. Suppose you run the following code.

```
rolls <- numeric(3)
for (i in 1:3) {
     rolls[i] <- sample(1:6, size = 1)
}
```

What could `rolls` contain?
a. 3
b. 0, 3, 6
c. 1, 3, 5
d. 0

Answers:

2. D. This is a biased sample of the most punctual students. Furthermore, students self-select where they sit. Although every student had the opportunity to sit in any seat, it is unlikely that seating is therefore random. More likely, students sit with their friends or choose seats in non-random idiosyncratic ways (e.g., keen or short-sighted students sitting in front) so the resulting sample is likely to be biased.

3. C. Weights and heights tend to be normally distributed, or at least approximately so, especially with appropriate stratification (e.g. by sex). D would be uniform, A would be roughly uniform (with interesting deviations reflecting larger societal trends), and B would skew to the right (most buildings are short, but some are 280+ m).

4. A. The for loop steps through each value of `vector`. During the first iteration, `i = 1`. During the second iteration, `i = 3`. During the third iteration, `i = 5`. Note that the values of `i` don't do anything to the computations within the for loop in this case! But it is important that the code inside the loop is executed three times. During the first iteration, `count` increases by 1 (`count <- 0 + 1`). During the second iteration, `count` increases by 1 again (`count <- 1 + 1`). During the third iteration, `count` increases by 1 a final time (`count <- 2 + 1`). The final value of count is therefore 3.

5. C. `rolls <- numeric(3)` sets up a vector of length 3, in which each element is 0. That is, `rolls[1]` is 0, `rolls[2]` is 0, and `rolls[3]` is 0. The code in the loop is executed 3 times, with `i` stepping through the values in 1:3. For example, during the second iteration, the executed code would be effectively `rolls[2] <- sample(1:6, size = 1)`. The result would be three values in rolls, with each value drawn randomly from 1:6.