

# Homework 1

IQM

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Question 1

Question 2

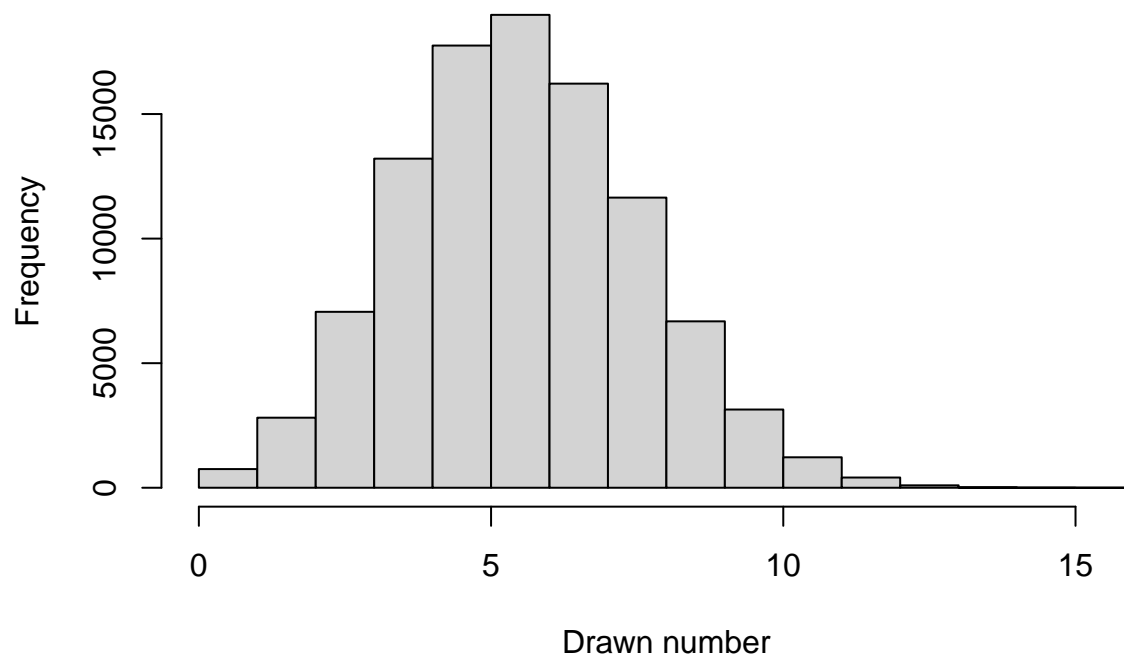
Question 3

Question 4

Question 5

Question 6

## Binomial distribution of $N=20$ , $p=0.3$



## Question 7

We can approximate the distribution of grades to be roughly normal given that the process of adding points on an exam is roughly a random walk. Linear transformations on normal distributions are normal. Therefore, algebraically, we can compare unitless z-scores to find the linear transformation.

$$\begin{aligned}\frac{y - \mu'}{\sigma'} &= \frac{x - \mu}{\sigma} \\ \sigma y &= \sigma' x - \sigma' \mu + \sigma \mu' \\ y &= \frac{\sigma'}{\sigma} x + \left( \mu' - \frac{\sigma'}{\sigma} \mu \right)\end{aligned}$$

Substituting  $\mu = 35$ ,  $\mu' = 100$ ,  $\sigma = 10$ , and  $\sigma' = 15$ ,

$$y(x) = 1.5x + 47.5 \rightarrow \{a = 47.5, b = 1.5\} \quad (\mathbf{a})$$

To find the range, we need to insert the limits of  $x$ , 0 and 50:

$$\begin{aligned}y(0) &= 1.5(0) + 47.5 \rightarrow y_{\min} = 47.5 \\ y(50) &= 1.5(50) + 47.5 \rightarrow y_{\max} = 122.5\end{aligned}$$

Thus, the range of  $y$  is  $[47.5, 122.5]$ . **(b)**

A plot of the linear transformation follows: **(c)**



Question 8

Question 9