

### Exercise 6.3 (Group exercise) - Solution

The probability of success is given as  $p = 0.27$ .

Following the theory regarding the Binomial distribution (Script, Section D.4), it is:

- a. The probability that the engineering office will have at least 1 success out of the 12 proposals submitted is:

$$\begin{aligned} p_Y(y) &= 1 - P(\text{no success}) = 1 - \binom{12}{0} 0.27^0 (1 - 0.27)^{12} = \\ &= 1 - \frac{12!}{0!(12-0)!} (1 - 0.27)^{12} = 1 - (1 - 0.27)^{12} \quad (\text{Check Equations D.52 and D.53}) \\ &= 0.9771 \end{aligned}$$

- b. The required probability can be estimated through the geometric distribution (Equation D.57):

$$p_Y(y) = p(1-p)^{y-1} = 0.27(1-0.27)^9 = 0.016.$$

c.

$$\begin{aligned} p_Y(y) &= P(\text{no success}) + P(\text{one success}) + P(\text{two successes}) = \\ &= \binom{13}{0} \cdot 0.27^0 \cdot (1-0.27)^{13} + \binom{13}{1} \cdot 0.27^1 \cdot (1-0.27)^{13-1} + \binom{13}{2} \cdot 0.27^2 \cdot (1-0.27)^{13-2} \\ &= (1-0.27)^{13} + 13 \cdot 0.27 \cdot (1-0.27)^{12} + \frac{13(13-1)}{2} \cdot 0.27^2 (1-0.27)^{11} \\ &= 0.275 \end{aligned}$$

(Check Equations D.52 and D.53)