In-class problem linked to lecture pages 47-59

Consider a room with 10 non-interacting fireflies. Each firefly illuminates 20% of the time. Calculate the probability that 30% are in the top half, 40% are in the right 1/3, and all are illuminated.

Physics 301
Answer to in-class problem. [illegible]
47-59:

$$P_{TOT} = P_{vertical} \cdot P_{horizontal} \cdot P_{illum.}$$

$$P = \frac{N!}{n!\,(N-n)!}\, p^{n} q^{N-n}$$

For $P_{vertical}$, $N = 10$
$n = 3$
$p = 0.5$
$q = 0.5$

$$P_{vertical} = \frac{10!}{3!\,7!}(0.5)^3(0.5)^7 = 0.117$$

For $P_{horizontal}$, $N = 10$
$n = 4$
$p = 0.33$
$q = 0.67$

$$P_{horizontal} = \frac{10!}{4!\,6!}(0.33)^4(0.67)^4 = 0.225$$

For P_{Pillow}, $N = 10$

$n = 10$

$p = 0.2$

$q = 0.8$

$$P_{\text{Pillow}} = \frac{10!}{10!\,0!}(0.2)^{10}(0.8)^{0} = 10^{-7}$$

$$P_{TOT} = (0.117)(0.225)\times 10^{-7} = 2.7 \times 10^{-9}$$