Assignment

EE23010: Probability and Random Processes
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Question: A cytoplasmic male-sterile female plant with the restorer (nuclear) genotype *rr* is crossed to a male-fertile male plant with the genotype *RR*. Both *RR* and *Rr* can restore the fertility, whereas *rr* cannot. When an $F1$ female plant with *Rr* genotype was test-crossed to a male-fertile male plant with the *rr* genotype, the percentage of the population that is male fertile would be?

Solution:

On crossing between *rr* and *RR* we get:

	R	R
r	Rr	Rr
r	Rr	Rr

TABLE 0
TABLE1: CROSSING BTW *RR* AND *rr*

$$F_1 = Rr, Rr, Rr, Rr \tag{1}$$

When F_1 (Rr) is test-crossed with *rr* we get:

	r	r
R	Rr	Rr
r	rr	rr

TABLE 0
TABLE2: CROSSING BTW *Rr* AND *rr*

Now, Let X be the random variable representing the gene.

$$X = \begin{cases} 1 & R \\ 0 & r \end{cases} \tag{2}$$

Probability that the population is male fertile is given by:

$$p_X(k) = {}^1C_k \left(\frac{1}{2}\right)^k \left(\frac{1}{2}\right)^{n-k} \tag{3}$$

$$p_X(1) = \frac{1}{2} \tag{4}$$

$\therefore$ The percentage of the population that is male fertile would be 50%