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:

Given, genotype of cytoplasmic male-sterile female plant is *rr*.

Genotype of male-fertile male plant is *RR*.

On cross between them (*rr*) and (*RR*) using Punnet square method we get:

	R	*R*
r	*Rr*	*Rr*
r	*Rr*	*Rr*

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

Now, Let X be the random variable representing the genotype of the F_1 female plant

$$p_X(Rr) = 1 \tag{2}$$

So, when F_1 female (*Rr*) genotype was test-crossed to male-fertile male (*rr*) genotype.

The following are the outcomes:

$$Rr, Rr, rr, rr \tag{3}$$

	r	*r*
R	*Rr*	*Rr*
r	*rr*	*rr*

Y be the random variable representing the genotype of male plant in test cross.

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

And, Z be the random variable represent the genotype of the male fertile offsprings So, the probability that the offspring is male fertile is :

$$p_Z(Rr) = \Pr(Z = Rr | X = Rr) \tag{5}$$

$$= \frac{1}{2} \tag{6}$$

which gives

$$p_Z(Rr) \times 100 = 50\% \tag{7}$$