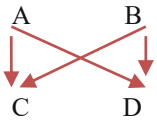
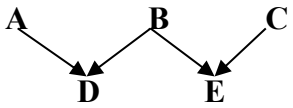
Relationship (R):-

Is the degree of similarity or association between two individuals resulting between them that carrying the same gene as a result of relationship



Relationship Between D and C = $\frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} = \frac{1}{2}$



Relationship Between D and E = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

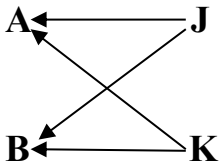
Relationship can be calculated as a relationship coefficient (Rxy)

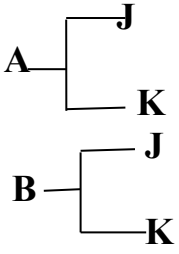
Rxy|=$\sum\left(\frac{1}{2}\right)^n$

*Whereas (n) is the number of generates or shares within the lineage.

the relationship coefficient (Rxy) = twice the probability of two genes at loci in different individuals being identical by descent. Rxy values can range from 0 to 2. Relationship can be calculated in several ways; from no.arro

no. arrow	sire
2	J
2	K



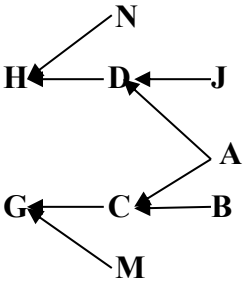


$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$

$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$

RAB|=$\sum\left(\frac{1}{2}\right)^2 = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$

e.g./ R_{JH}? , R_{GH}?



	no. arrow	sire	
$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$	2	A	RGH
$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$	2	A	
$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$	2	J	RJH

Inbreeding

In breeding can be calculated as a inbreeding coefficient (F)

$F = \frac{1}{2} R_{XY}$

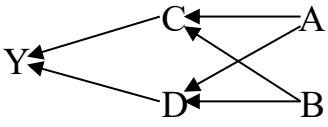
Coefficient of inbreeding (F)

The *coefficient of inbreeding* (F) is the probability that two alleles at a randomly chosen locus are identical by descent (IBD)

*IBD = **copies of same alleles from common ancestor***

F ranges from 0 to 1

- In breeding
  - Mating with relatives
  - Increases homozygosity
- Out breeding
  - Mating with non-relatives
  - Increases heterozygosity



Fy=? , $Fy = \frac{1}{2} R_{CD}$

R_{CD} = ?

Sire	no. arrow	
A	2	$(\frac{1}{2})^2 = \frac{1}{4}$
B	2	$(\frac{1}{2})^2 = \frac{1}{4}$

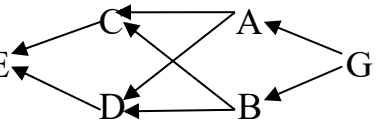
$R_{CD} = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$

$Fy = \frac{1}{2} R_{CD} \Longrightarrow \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

same formula for the relationship between X and Y as before, but now including the inbreeding level (F) of the common ancestor. F indicates how much more likely it is that the same allele is passed on to two offspring.

$$R_{xy} = \frac{[\sum(\frac{1}{2})^2 (1+FCP)}{\sqrt{(1+FX)\times(1+FY)}}$$

e.g./



R_{EG}=? , R_{CD}=? , R_{AB}=? , FE=? , FD=? , FC=?

R_{AB}=?

Sire	no. arrow	
G	2	$(\frac{1}{2})^2 = \frac{1}{4}$

FG =0 FA=0 FB=0

R_{CD}=?

Sire	no. arrow	
A	2	$(\frac{1}{2})^2 = \frac{1}{4}$
B	2	$(\frac{1}{2})^2 = \frac{1}{4}$
G	4	$(\frac{1}{2})^4 = \frac{1}{16}$
G	4	$(\frac{1}{2})^4 = \frac{1}{16}$

$\frac{10}{16} = \frac{5}{8}$

$$R_{CD} = \frac{\frac{5}{8}}{\sqrt{(1+FC)\times(1+FD)}} = \frac{\frac{5}{8}}{\sqrt{(1+\frac{1}{8})\times(1+\frac{1}{8})}} = \frac{5}{9}$$

$FC = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

$FD = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

FA= 0 , FB=0

REG=?

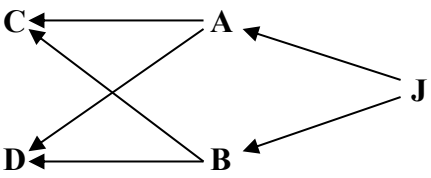
Sire	no. arrow	
G	3	$(\frac{1}{2})^3=\frac{1}{8}$
G	3	$(\frac{1}{2})^3=\frac{1}{8}$
G	3	$(\frac{1}{2})^3=\frac{1}{8}$
G	3	$(\frac{1}{2})^3=\frac{1}{8}$

$$\frac{4}{8}=\frac{1}{2}$$

$$R_{EG}=\frac{\frac{1}{2}}{\sqrt{(1+FE)\times(1+FG)}}\Longrightarrow\frac{\frac{1}{2}}{\sqrt{\left(1+\frac{5}{16}\right)\times(1+0)}}=0.436$$

$$FE=\frac{1}{2}\times\frac{5}{8}=\frac{5}{16}$$

FG= 0



Sire	no. arrow	
J	4	$(\frac{1}{2})^4=\frac{1}{16}$
J	4	$(\frac{1}{2})^4=\frac{1}{16}$
A	2	$(\frac{1}{2})^2=\frac{1}{4}$
B	2	$(\frac{1}{2})^2=\frac{1}{4}$

$$\frac{5}{8}=$$

FJ=0 **FA=0** **FB=0**

FC= $\frac{1}{2}$ **R_{AB}**

RAB=

Sire	no. arrow	
J	2	$(\frac{1}{2})^2=\frac{1}{4}$

FC= $\frac{1}{2}\times\frac{1}{4}=\frac{1}{8}$

FD= $\frac{1}{2}\times\frac{1}{4}=\frac{1}{8}$

$$R_{CD}=\frac{\frac{5}{8}}{\sqrt{(1+FC)\times(1+FD)}}=\Longrightarrow\frac{\frac{5}{8}}{\sqrt{\left(1+\frac{1}{8}\right)\times\left(1+\frac{1}{8}\right)}}=\frac{\frac{5}{8}}{\sqrt{\left(\frac{9}{8}\right)\times\left(\frac{9}{8}\right)}}=\frac{\frac{5}{8}}{\frac{9}{8}}$$

$$=\frac{5}{\cancel{8}}\times\frac{\cancel{8}}{9}=\frac{5}{9}$$