MATH 301 – SOLUTION HOMEWORK 05

Sections: 171, 174

Q-1. Among the following events, which pair (***A***, ***B***), (***A***, ***C***), or (***B***, ***C***) are mutually exclusive.

A: a plant is an annual; ***B***: a plant is non flowering; ***C***: a plant is a violet.

SOLUTION: A and B are mutually exclusive

B and C are mutually exclusive

Q-2. In each case state whether you think ***A*** and ***B*** are independent or dependent.

(a) ***A***: a rabbit is inoculated with polio virus; ***B***: the rabbit's blood contains antibodies to measles.

(b) ***A***: a man has high blood pressure; ***B***: a man is overweight.

SOLUTION:

(a) A and B are independent

(b) A and B are dependent (or not independent)

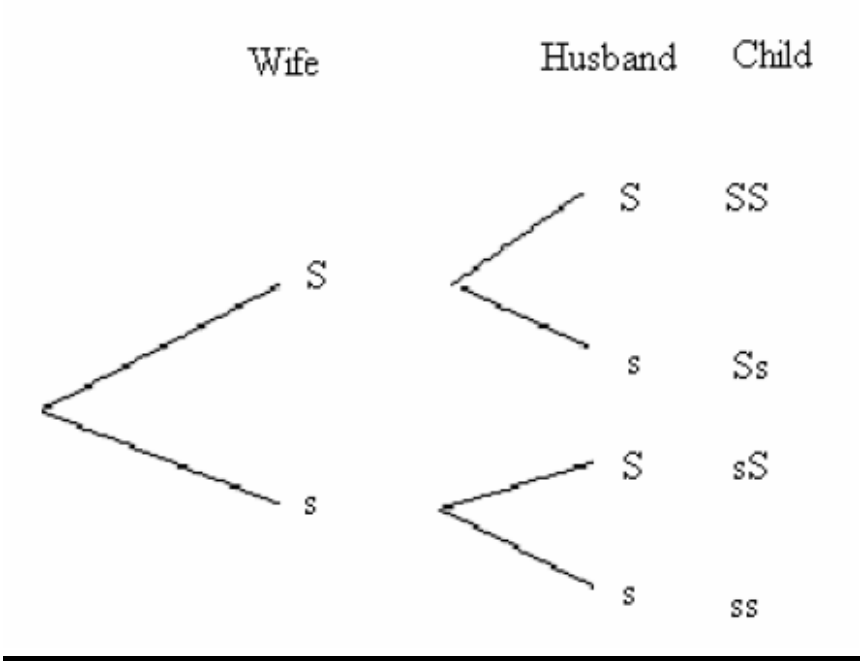
Q-3. Sickle-cell anemia is a fatal condition in which red blood cells tend to assume a sickle shape in the blood vessels. Let *S* denote the allele responsible for normal red blood cells and *s* the allele which leads to the formation of sickle cells. An individual will have sickle-cell anemia if his/her genotype is *ss*. Suppose that both a wife and husband have genotype *Ss* and that they are expecting a child.

(a) Use a tree diagram to list the possible genotypes of the child.

(b) Find the probability the child will develop sickle-cell anemia.

SOLUTION:

(a) We have the following tree diagram



(b) P(the child develops sickle-cell anemia) = 1/4 or 0.25

Q-4. A company has 4 applicants for 2 positions: 1 woman and 3 men.

(a) Use a tree diagram to list all the possible assignments to positions (HINT: Label the applicants as M1, M2, M3, and W1; assume an individual may only hold one position)

Supposing that all applicants are qualified and that no preference is given for choosing either sex so that all outcomes in (a) are equally-likely, answer the following.

(b) Find the probability that two males are chosen to fill the 2 positions.

(c) Find the probability that a male is chosen to fill the first position.

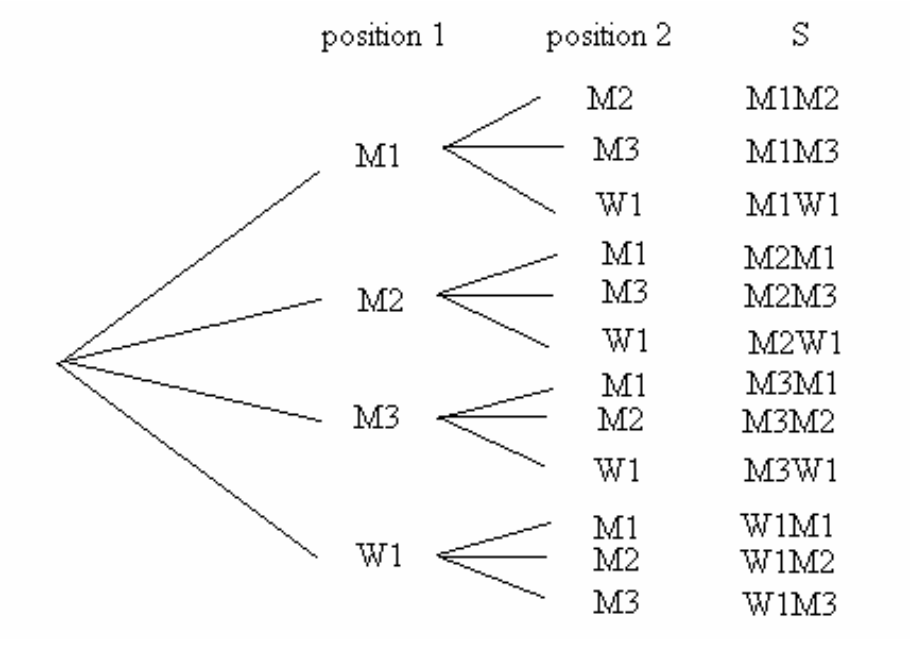
(d) Find the probability that a male is chosen to fill the second position.

(e) Find the probability that a male will be chosen to fill the second position given that a male has been chosen to fill the first position.

(f) What do the answers to (d) and (e) tell you about the connection, if any, between the events "a male is chosen to fill the first position" and "a male is chosen to fill the second position".

SOLUTION:

(a) We have the following tree diagram.



(b) P(two males are chosen) = 6/12 or .5

(c) P(a male fills the first position) = 9/12 or .75

(d) P(a male fills the second position) = 9/12 or .75

(e) P(a male in the second position | a male in the first position) = P(both)/P(given) = .5/.75 = 0.666... or 2/3

(f) The events are dependent since P(male 2nd | male 1st) ≠ P(male 2nd).