Note Title 1/5/2012

EVENT A AND B

- TO CALCULATE THE PROBABILITY THAT "A" AND "B" WILL OCCUR IE. A ON THE 1st TRIAL AND B ON THE SECOND, WE WILL DETERMINE THE PROBABILITY OF B GIVEN THAT "A" HAS OCCURED.

$$P(B \mid A)$$

PROBABILITY THAT B OCCURS

GIVEN THAT

EVENT "A" HAS OCCURED

- THE $P(B|A)$ MAY BE THE SAME AS $P(B)$ DEPENDING ON WHETHER A AND B ARE DEPENDENT EVENTS.

TO CALCULATE $P(A \text{ AND } B) = P(A) \times P(B|A)$

- IF A AFFECTS B THEN DEPENDENT EVENTS
- IF A AND B ARE INDEPENDENT THEN

$$P(B|A) = P(B) \quad \text{SO} \quad P(A \text{ AND } B) = P(A) \times P(B)$$

<u>IE</u> DRAWING TWO FACE CARDS FROM DECK

1. WITHOUT REPLACEMENT
2. WITH REPLACEMENT

SOLN

1. 12 FACE CARDS, 52 CARDS IN A DECK

1ST DRAW $\frac{12}{52}$ $\times$ 2ND DRAW $\frac{11}{51}$ $= \frac{11}{221}$

$$P(A \text{ AND } B) = P(A) \times P(B|A)$$

$$= \frac{12}{52} \times \frac{11}{51} = \frac{11}{221}$$

2. $\frac{12}{52} \times \frac{12}{52} = \frac{9}{169}$

CONDITIONAL PROBABILITY

- IF A AND B ARE EVENTS FROM AN EXPERIMENT, THE CONDITIONAL PROBABILITY OF B GIVEN A IS THE PROBABILITY THAT THE EVENT B WILL OCCUR GIVEN THAT THE EVENT A HAS ALREADY OCCURED. THE CONDITIONAL PROBABILITY IS EQUAL TO THE PROBABILITY THAT B AND A WILL OCCUR DIVIDED BY THE PROBABILITY THAT B WILL OCCUR.

$$P(A \mid B) = \frac{P(B \text{ AND } A)}{P(B)}, \quad P(B) \neq 0$$

* BAYES FORMULA *

IE A TEST FOR TYPE 2 DIABETES MEASURES THE BLOOD GLUCOSE LEVEL AFTER 8 HOURS OF FASTING. GLUCOSE ABOVE NORMAL IS A POSITIVE RESULT, ALL ELSE IS NEGATIVE. THE TEST IS 85% ACCURATE AND 2% OF THE WORLDS POPULATION ACTIVELY HAS DIABETES.

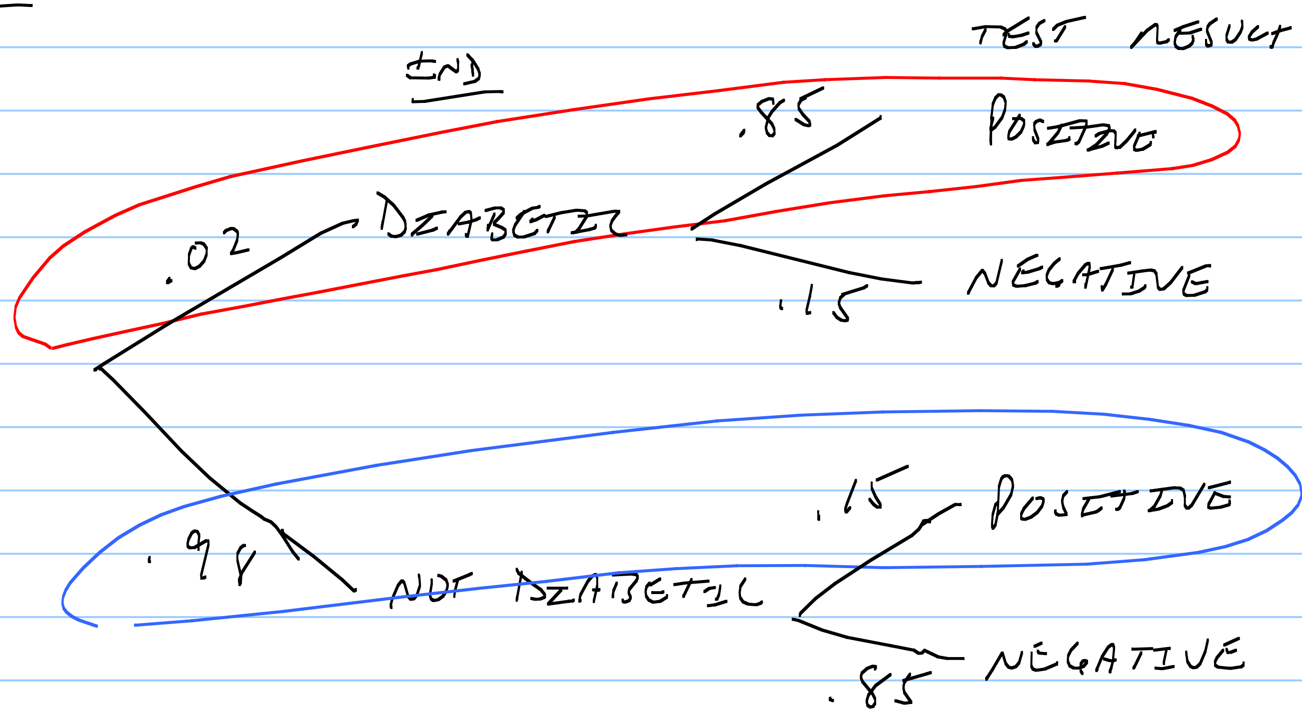
DETERMINE A) $P(\text{DIABETIC} \mid \text{POSITIVE})$

B) P(NOT DIABETIC | NEGATIVE)

C) P(POSITIVE | DIABETIC)

D) IS THE TEST EFFECTIVE

<u>SOLN</u> DRAW A PROBABILITY TREE



$$P(\text{DIA} + \text{POS}) = .02 \times .85 = 0.017$$
$$P(\text{DIA} + \text{NEG}) = .02 \times .15 = .003$$
$$P(\overline{\text{DIA}} + \text{POS}) = .98 \times .15 = .147$$
$$P(\overline{\text{DIA}} + \text{NEG}) = .98 \times .85 = .833$$

A) $$P(\text{TEST POSITIVE}) = P(\text{DIA} + \text{POS}) + P(\overline{\text{DIA}} + \text{POS})$$
$$= .017 + .147 = .164$$

$$\therefore P(\text{DIA} \mid \text{TEST POS}) = \frac{P(\text{DIA} + \text{POS})}{P(\text{TEST POS})}$$
$$= \frac{.017}{0.164} = .104$$

B) $P(\text{TEST NEG}) = P(\text{DIA} + \text{NEG}) + P(\overline{\text{DIA}} + \text{NEG})$

$$= .003 + .833 = .836$$

$$\therefore P(\overline{\text{DIA}} \mid \text{NEG}) = \frac{P(\overline{\text{DIA}} + \text{NEG})}{P(\text{TEST NEG})}$$

$$= \frac{.833}{.836} = .996$$

c) $P(\text{POS} \mid \text{DIA}) = \dfrac{P(\text{TEST POS} + \text{DIA})}{P(\text{DIA})}$

$$= \frac{.017}{.02} = 0.85$$

H/w Pg 429 # 1–9, 11, 13, 14, 16, 19,

23, 26, 27 AE, 28

439 # 1–3, 5, 7, 12