Math 483 HW 4 2023. Due Thursday, Sept. 7. Two pages problems A)-I).

A) 2.71ab If two events, A and B, are such that P(A) = 0.5, P(B) = 0.3 and $P(A \cap B) = 0.1$, find the following: a) $P(A|B)$ b) $P(B|A)$

comment: Follow ex. 2.14 on p. 53. 2.71ab means only do a) and b).

B) 2.72 For a certain population of employees the percentage passing or failing a job competency exam, listed according to sex, were as shown in the table below. That is, of all the people taking the exam, 24% were in the male-pass category, 16% were in the male-fail category, and so forth. An employee is to be selected randomly from this population. Let A be the event that the employee scores a passing grade on the exam, and let M be the event that a male is selected.

Are the events A and M independent? Are the events $\overline{A}$ and F independent?

	Sex		
outcome	Male(M)	Female(F)	total
Pass(A)	24	36	60
Fail($\overline{A}$)	16	24	40
total	40	60	100

comment: See ex. 2.15 on p. 53-4. I prefer the multiplication law.

C) 2.77acdfh A study of posttreatment behavior of a large number of drug abusers suggests that the likelihood of conviction within a 2-year period after treatment may depend on the offenders education. The proportions of the total number of cases falling in four education-conviction categories is tabled below.

	status within 2 years after treatment		
Education	convicted	not convicted	totals
10 years or more	0.10	0.30	0.40
9 years or less	0.27	0.33	0.60
totals	0.37	0.63	1.00

Suppose a single offender is selected from the treatment program. Define the events

A: The offender has 10 or more years of education.

B: The offender is convicted within 2 years after treatment.

(C continued) Find a) P(A) c) P(AB) d) $P(A \cup B)$ f) $P(\overline{A \cup B})$ h) $P(A|B)$

comment: Assume that the person is randomly selected so that the proportions are probabilities. Recall that AB means "A intersect B." Show work for d), f), and h).

D) 2.80 Suppose $A \subset B$ and that $P(A) > 0$ and $P(B) > 0$. Are A and B independent? Prove your answer.

comment Assume that $P(B) < 1$. The second condition in DEF 2.10 may be useful.

E) 2.92 Suppose hospital employees are required to take lie detector tests. Suppose that the probability is 0.05 that the lie detector concludes that a person is lying who, in fact, is telling the truth. Suppose that any pair of tests is independent.
a) What is the probability that the lie detector will conclude that each of three employees is lying when all are telling the truth?
b) What is the probability that the lie detector will conclude that at least one of three employees is lying when all are telling the truth?

comment: See ex 2.20 on p. 65-6 and a more general ex. done in class.

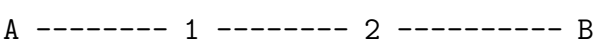
F) 2.95a Suppose $P(A) = 0.2$, $P(B) = 0.3$ and $P(A \cup B) = 0.4$. Find $P(A \cap B)$.

comment: Use the additive law on p. 58.

G) 2.96ab If A and B are independent events with $P(A) = 0.5$ and $P(B) = 0.2$, find the following. a) $P(A \cup B)$ b) $P(\ \overline{A} \cap \overline{B}\ )$

comment: a) Use the mult. law and add. law. b) Use complement rule and mult. law. or comp. rule and DeMorgan's laws.

H) 2.98 Suppose current flows from point A to point B if there is at least one closed path when relays work. Suppose that the relays work or fail independently of one another and that each relay works with probability 0.9. Compare the probability of current flowing from A to B in the series system shown



with the parallel system shown.

comment: A series system works if both (all) work (intersection) while a parallel system works if at least one works (union).

I) 2.116 A communications network has a built-in safeguard system against failures. In this system if line I fails, it is bypassed and line II is used. If line II also fails, it is bypassed and line III is used. The probability of failure of any one of these three lines is 0.01, and the failures of these lines are independent events. What is the probability that this system of three lines does not completely fail?

comment: See comments for E) and H).