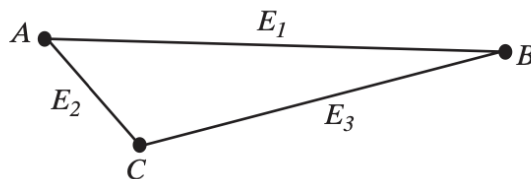


Due by 4pm on Friday, September 20. Please leave your homework on the table before class begins on Friday or leave it in the dropbox outside my office. Do not forget to attach the honor code. Each problem is worth 10 points.

- (1) The possibility of importing liquified natural gas (LNG) from Algeria has been suggested as one way of coping with a future energy crunch. Complicating matters, though, is the fact that LNG is highly volatile and poses an enormous safety hazard. Any major spill occurring near a U.S. port could result in a fire of catastrophic proportions. The question, therefore, of the *likelihood* of a spill becomes critical input for future policymakers who may have to decide whether or not to implement the proposal. Two numbers need to be taken into account: (1) the probability that a tanker will have an accident near a port, and (2) the probability that a major spill will develop given that an accident has happened. Although no significant spills of LNG have yet occurred anywhere in the world, these probabilities can be approximated from records kept on similar tankers transporting less dangerous cargo. On the basis of such data, it has been estimated that the probability is $8/50,000$ that an LNG tanker will have an accident on any one trip. Given that an accident *has* occurred, it is suspected that only three times in fifteen thousand will the damage be sufficiently severe that a major spill would develop. What are the chances that a given LNG shipment would precipitate a catastrophic disaster?
- (2) The highways connecting two resort areas at A and B are shown in the following figure. There is a direct route through the mountains and a more circuitous route going through a third resort area at C in the foothills. Travel between A and B during the winter months is not always possible, the roads sometimes being closed due to snow and ice. Suppose we let E_1 , E_2 , and E_3 denote the events that highways AB , AC , and BC are passable, respectively, and we know from past years that on a typical winter day,



$$P(E_1) = \frac{2}{5}, P(E_2) = \frac{3}{4}, P(E_3) = \frac{2}{3}$$

and

$$P(E_3|E_2) = \frac{4}{5}, P(E_1|E_2 \cap E_3) = \frac{1}{2}$$

What is the probability that a traveler will be able to get from A to B ?

- (3) According to your neighborhood bookie, five horses are scheduled to run in the third race at the local track, and handicappers have assigned them the following probabilities of winning:

Home	Probability of Winning
Scorpion	0.10
Starry Avenger	0.25
Australian Doll	0.15
Dusty Stake	0.30
Outandout	0.20

Suppose that Australian Doll and Dusty Stake are scratched from the race at the last minute. What are the chances that Outandout will prevail over the reduced field?

- (4) Suppose events A and B are such that $P(A \cap B) = 0.1$ and $P((A \cup B)^c) = 0.3$. If $P(A) = 0.2$, what does $P[(A \cap B)|(A \cup B)^c]$ equal?
- (5) An urn contains one red chip and one white chip. One chip is drawn at random. If the chip selected is red, that chip together with two additional red chips are put back into the urn. If a white chip is drawn, the chip is returned to the urn. Then a second chip is drawn. What is the probability that both selections are red?

(6) Given that $P(A) = a$ and $P(B) = b$, show that

$$P(A|B) \geq \frac{a + b - 1}{b}$$

(7) Two events, A and B , are defined on a sample space S such that $P(A|B) = 0.6$, $P(\text{At least one of the events occurs}) = 0.8$, and $P(\text{Exactly one of the events occurs}) = 0.6$. Find $P(A)$ and $P(B)$.

(8) Suppose that four cards are drawn from a standard 52-card poker deck. What is the probability of drawing, in order, a 7 of diamonds, a jack of spades, a 10 of diamonds, and a 5 of hearts?

(9) In an upstate congressional race, the incumbent Republican (R) is running against a field of three Democrats (D_1, D_2 , and D_3) seeking the nomination. Political pundits estimate that the probabilities of D_1, D_2 , or D_3 winning the primary are 0.35, 0.40, and 0.25, respectively. Furthermore, results from a variety of polls are suggesting that R would have a 40% chance of defeating D_1 in the general election, a 35% chance of defeating D_2 , and a 60% chance of defeating D_3 . Assuming all these estimates to be accurate, what are the chances that the Republican will retain his seat?

(10) Three chips are placed in an urn. One is red on both sides, a second is blue on both sides, and the third is red on one side and blue on the other. One chip is selected at random and placed on a table. Suppose that the color showing on that chip is red. What is the probability that the color underneath is also red?

