Statistics Chapter 6 Answer key by Michael Reiner

1) In a standard deck of cards there are 4 suits.
2 Red Suits which are Hearts and Diamonds
2 Black suits which are Clubs and Spades
In each suit there are 13 cards Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen and King
There are 4 kings in the deck

$$P(\text{king}) = \frac{4}{52} = 0.076923077$$

2) We use the compliment rule to calculate not picking a king because we know the probability of picking a king

$$P(\text{Not king}) = 1 - P(\text{king}) = 1 - 0.076923077 = 0.923076923$$

3) Now we have the word "or" which means addition of probability

2 Rules of Addition

Special Rule is used when the events are mutually exclusive

$$P(A \text{ or } B) = P(A) + P(B)$$

General Rule is used when there is a joint (shared) probability between the 2 events

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$P(A \text{ and } B)$ = Joint Probability

P(Queen or Diamond) Queen is a face card
Diamond is a suit

this means there is a Queen that is a diamond, so, we have joint probability, we must use general rule

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3) $P(\text{Queen}) = \frac{4}{52}$ $P(\text{Diamond}) = \frac{13}{52}$ $P(\text{Queen and Diamond}) = \frac{1}{52}$

$$P(\text{Queen or Diamond}) = \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = 0.307692308$$

4) $P(\text{Heart or Spade})$ Heart is a suit
Spade is a suit
Since we are using suits and not individual cards, we must now use the special rule

$P(\text{Heart}) = \frac{13}{52}$ $P(\text{Spade}) = \frac{13}{52}$.

$$P(\text{Heart or Spade}) = \frac{13}{52} + \frac{13}{52} = \frac{26}{52} = 0.50$$

5) Now we are talking about "without replacement" which means multiplication of probabilities

2 Rules of Multiplication
Special Rule is used "with replacement" because each event is independent
$P(A \text{ and } B) = P(A)P(B)$

General Rule is used "without replacement" because the second event is dependent on the first event succeeding
$P(A \text{ and } B) = P(A)P(B|A)$
$B|A$ means B happens after A has occured
| = occurred

5) a) i) "without replacement" - use the general rule

P(Right and Right) = P(1st Right) P(2nd Right)

1st Right = $\frac{7}{9}$ if we are successful then 2nd Right = $\frac{6}{8}$

P(Right and Right) = $\frac{7}{9} \times \frac{6}{8} = 0.58\overline{3}$

a)ii) P(Right and Left) = P(Right) P(Left)

1st Right = $\frac{7}{9}$ 2nd Left = $\frac{2}{8}$.

P(Right and Left) = $\frac{7}{9} \times \frac{2}{8} = 0.194$

b) "without replacement" - use the general rule

P(Left and Left and Left) = P(1st Left) P(2nd Left) P(3rd Left)

1st Left = $\frac{2}{9}$ 2nd Left = $\frac{1}{8}$ 3rd Left = $\frac{0}{7}$

P(Left and Left and Left) = $\frac{2}{9} \times \frac{1}{8} \times \frac{0}{7} = 0$

c) d) i) with replacement - use the special rule

P(Right and Right) = P(Right) P(Right) P(Right = $\frac{7}{9}$

P(Right and Right) = $\frac{7}{9} \times \frac{7}{9} = 0.604938272$

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5) c) b) P(Left and Left and Left) = P(Left) P(Left) P(Left) $P(\text{Left}) = \frac{2}{9}$

$P(\text{Left and Left and Left}) = \frac{2}{9} \times \frac{2}{9} \times \frac{2}{9} = 0.010973937$

6) a) P(Yes Bank Credit Card) = 0.6

b) P(No Bank Credit Card) = 1 − P(Yes Bank Credit Card)

1 − 0.6 = 0.4

c) P(Yes Entertainment Credit Card) = 0.375

d) "and" means joint probability, so we want to find where the two events intersect on the table.

P(Yes Bank Credit Card and Yes Entertainment Credit Card)

= 0.3

e) "or" means addition

P(Yes BCC or Yes ECC) = P(Yes BCC) + P(Yes ECC) − P(Yes BCC and Yes ECC)

P(Yes BCC) = 0.6 P(Yes ECC) = 0.375 P(Yes BCC and ECC) = 0.3

0.6 + 0.375 − 0.3 = 0.675

F) "or" means addition

P(No BCC or Yes ECC) = P(No BCC) + P(Yes ECC) − P(No BCC and Yes ECC)

P(No BCC) = 0.4 P(Yes ECC) = 0.375 $P(\text{No BCC or Yes ECC}) = \frac{15}{200} = 0.075$

0.4 + 0.375 − 0.075 = 0.7

6)g) "Given" is a special situation. Given means one of the events has already occurred and based on that one event occurring we now have to find the joint probability that the second event will occer.

Given = No Entertainment Card = 0.625 (this number goes on the bottom of our Fraction)
Yes Bank Credit Card and No Entertainment Card = 0.30

P(Yes Bank Credit Card Given No Entertainment Card) = $\frac{0.30}{0.625} = 0.48$