Math 114
Chapter 3, Practice Test

Part I

Write the sample space for the following experiments:

1. tossing a coin {h, t}	**2.** choosing from four aces (one of each suit) { A♥, A♦, A♠, A♣}
3. tossing a coin and choosing from four aces (one of each suit) { (h, A♥), (h, A♦), (h, A♠), (h, A♣), (t, A♥), (t, A♦), (t, A♠), (t, A♣) }	**4.** tossing a coin and rolling a 6-sided die {(h, 1), (h, 2), (h, 3), (h, 4), (h, 5), (h, 6), (t, 1), (t, 2), (t, 3), (t, 4), (t, 5), (t, 6)}

Find the probabilities of the following events. *Write your answer as a reduced fraction*.

5. the outcome of tossing a coin is a head $\frac{1}{2}$	**6.** the outcome of tossing two coins is two heads $\frac{1}{4}$
7. the outcome of choosing from four aces (one of each suit) is an ace of hearts $\frac{1}{4}$	**8.** the outcome of tossing a coin and rolling a 6-sided die is a tail and a 3 $\frac{1}{12}$

9. $E = \{1, 3, 6\}$ and $S = \{1, 2, 3, 4, 5, 6\}$ $\bar{E} = \{2, 4, 5\}$	**10.** $E = \{T, Th\}$ and $S = \{S, M, T, W, Th, F, Sa\}$ $\bar{E} = \{S, M, W, F, Sa\}$
11. $E = \{M, T, W\}$, $G = \{T, Th, F\}$ E and G = {T}	**12.** $E = \{M, T, W\}$, $G = \{T, Th, F\}$ E or G = {M, T, W, Th, F}

Part II

A jar contains 40 jelly beans, 20 of which are yellow, 17 are red, 2 are green, and 1 is blue. Jelly beans will be drawn randomly from the jar.

A = {yellow jelly beans} B = {red jelly beans}
C = {green jelly beans} D = {blue jelly bean}

Write all probabilities on this page as reduced fractions.

For #13 – 16, assume one jelly bean is drawn.

13. $P(A) = \frac{20}{40} = \frac{1}{2}$	**14.** $P(A \text{ or } D) = \frac{21}{40}$
15. $P(A \text{ and } C) = 0$	**16.** $P(A \text{ or } \bar{A}) = 1$

For #17 – 20, assume two jelly beans are drawn **with** replacement. Subscripts are used to represent 1st and 2nd draw.

17. $P(A_1 \text{ and } C_2) = \frac{20}{40} \bullet \frac{2}{40} = \frac{1}{40}$	**18.** $P(A_1 \text{ and } A_2) = \frac{20}{40} \bullet \frac{20}{40} = \frac{1}{4}$
19. $P(B_1 \text{ and } B_2) = \frac{17}{40} \bullet \frac{17}{40} = \frac{289}{1600}$	**20.** $P(D_1 \text{ and } D_2) = \frac{1}{40} \bullet \frac{1}{40} = \frac{1}{1600}$

For #21 – 24, assume two jelly beans are drawn **without** replacement.

21. $P(A_1 \text{ and } C_2) = \frac{20}{40} \bullet \frac{2}{39} = \frac{1}{39}$	**22.** $P(A_1 \text{ and } A_2) = \frac{20}{40} \bullet \frac{19}{39} = \frac{19}{78}$
23. $P(B_1 \text{ and } B_2) = \frac{17}{40} \bullet \frac{16}{39} = \frac{17}{5} \bullet \frac{2}{39} = \frac{34}{195}$	**24.** $P(D_1 \text{ and } D_2) = \frac{1}{40} \bullet \frac{0}{40} = 0$

Part III

Cards will be drawn from a standard, 52-card deck in an experiment.

A = {diamonds}	B = {even numbered cards}
C = {black cards}	D = {kings}

Write all probabilities as reduced fractions.

For #25 – 30, assume one card is drawn.

25. $P(A \text{ or } B) =$ $\frac{13}{52}+\frac{20}{52}-\frac{5}{52}=\frac{28}{52}=\frac{7}{13}$	**26.** $P(B \text{ or } D) =$ $\frac{20}{52}+\frac{4}{52}=\frac{24}{52}=\frac{6}{13}$
27. $P(A \text{ and } B) =$ $\frac{5}{52}$	**28.** $P(B \text{ and } D) =$ 0
29. Are events A and B above mutually exclusive? Yes **[No]**	**30.** Are events B and D above mutually exclusive? **[Yes]** No

For #31 – 34, assume two cards are drawn **with** replacement. Subscripts are being used to represent 1st card drawn and 2nd card drawn.

31. $P(D_1 \text{ and } D_2) =$ $\frac{4}{52}\bullet\frac{4}{52}=\frac{1}{169}$	**32.** $P(D_1 \text{ and } B_2) =$ $\frac{4}{52}\bullet\frac{20}{52}=\frac{5}{169}$
33. $P(D_2 \mid D_1) =$ $\frac{4}{52}=\frac{1}{13}$	**34.** Are events D_1 and D_2 for this experiment independent? **[Yes]** No

For #35 – 38, assume two cards are drawn **without** replacement. Subscripts are being used to represent 1st card drawn and 2nd card drawn.

35. $P(D_1 \text{ and } D_2) =$ $\frac{4}{52}\bullet\frac{3}{51}=\frac{12}{663}$	**36.** Are events D_1 and D_2 in this experiment independent? Yes **[No]**
37. $P(\text{Blackjack}) =$ $\frac{4}{52}\bullet\frac{16}{51}+\frac{4}{52}\bullet\frac{16}{51}=\frac{16}{663}+\frac{16}{663}=\frac{32}{663}$	**38.** $P(\sim\text{Blackjack}) =$ $1-\frac{32}{663}=\frac{663}{663}-\frac{32}{663}=\frac{631}{663}$

Part IV

A blood bank asserts that a person with type O blood and a negative Rh factor (Rh−) can donate blood to any person with any blood type. Of a sample of 1200 people, 41% have type O blood and 17% of people have Rh− factor; 47% of people have type O or Rh− factor.

		X	*Y*	*Total*
		Type O	*Not Type O*	
C	*Rh +*	**.47 – .17 = .30**	**.83 – .30 = .53**	**1 – .17 = .83**
D	*Rh–*	**.41 – .30 = .11**	**.17 – .11 = .06**	**.17**
Total		**.41**	**1 – .41 = .59**	**1**

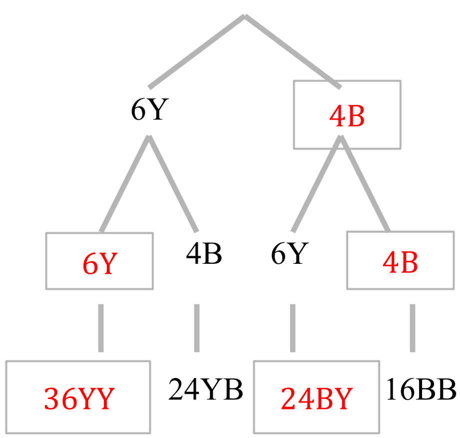
Write all probabilities as decimals rounded, if necessary, to the nearest hundredth.

43. $P(X) =$ **.41**	**44.** $P(X \text{ or } C) =$ **1 – 0.06 = 0.94**
45. $P(C \mid Y) \approx$ **0.90**	**46.** $P(Y \text{ and } C) =$ **.53**

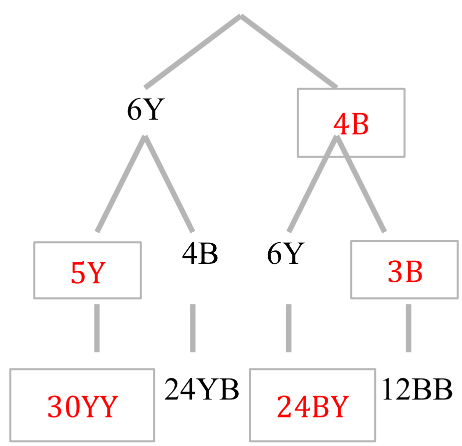
Part V

A jar contains 10 jelly beans, 6 of which are yellow and 4 are blue. Two jelly beans will be drawn randomly from the jar. Complete the diagrams and use them to help you answer the questions below.

Two jelly beans are drawn with replacement.



Two jelly beans are drawn without replacement.



47. P(one of each color) = $\frac{24}{100} + \frac{24}{100} = \frac{48}{100} = 0.48$	**48.** P(one of each color) = $\frac{24}{90} + \frac{24}{90} = \frac{48}{90} = 0.5\overline{3}$

Reference

Classical probability of event, E, within the sample space, S	$\frac{\text{number of outcomes in } E}{\text{total number of outcomes in the sample space}}$ $P(E) = \frac{n(E)}{N(S)}$
Empirical probability of event, E, of a frequency distribution	$\frac{\text{frequency for the class}}{\text{total frequencies in the distribution}} = \frac{f}{n}$ $P(E) = \frac{f}{n}$
Complementary events, E and $\bar{E}$	$P(\bar{E}) = 1 - P(E)$ $P(E) = 1 - P(\bar{E})$ $P(E) + P(\bar{E}) = 1$
The *conditional probability* of an event B with respect to event A is the probability that event B occurs after A has already occurred, denoted $P(B\|A)$.	$P(B\|A) = \frac{P(A \text{ and } B)}{P(A)}$
Two events, A and B are *independent* if the fact that A occurs does not affect the probability of B occurring.	For independent events: $P(B\|A) = P(B)$
Two events are *mutually exclusive* if they cannot occur at the same time.	For mutually exclusive events, $P(A \text{ and } B) = 0$.
For any two events, A and B	$P(A \text{ and } B) = P(A) \bullet P(B\|A)$
For any two events, A or B	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

Standard 52-Card Deck