1. (10pts) In 2012, elections are held for 33 Senate seats. The table below breaks down the current make-up of the senate by party affiliation and whether the senator does not face an election this year, is running for re-election, or is retiring from the Senate.

Party	Dem.	Ind.	Rep.
No election	30	0	37
Incumbent running	15	1	3
Incumbent retiring	6	1	7

If a current random senator is selected, what is the probability that the senator
a) is a Democrat?   b) is an incumbent running?
c) a retiring Republican?
d) does not face an election in 2012?

Total : 100

a) $\dfrac{30+15+6}{100} = \dfrac{51}{100}$ b) $\dfrac{15+1+3}{100} = \dfrac{19}{100}$ c) $\dfrac{7}{100}$ d) $\dfrac{30+37}{100} = \dfrac{67}{100}$

$\left[\text{d) may also be interpreted to have answer} \quad \dfrac{30+37+6+1+7}{100} = \dfrac{81}{100} \right]$

2. (20pts) Write the probabilities and odds against and in favor of the following events (show any work needed below):

Event	probability	odds against	odds in favor
a) Drawing a jack from a deck of cards	$\frac{4}{52} = \frac{1}{13}$	$48:4 = 12:1$	$1:12$
b) Rolling an odd number on a die	$\frac{3}{6}$	$3:3 = 1:1$	$1:1$
c) Drawing a black odd-number card from a deck of cards	$\frac{10}{52} = \frac{5}{26}$	$42:10 = 21:5$	$5:21$
d) Getting exactly one tail on three coin tosses	$\frac{3}{8}$	$5:3$	$3:5$
e) Getting numbers 1 apart on a roll of two dice (e.g., 3 and 4)	$\frac{10}{36} = \frac{5}{18}$	$26:10 = 13:5$	$5:13$

a) 4 jacks in a deck of 52 cards

b) Odd numbers = 1, 3, 5

c) Odd numbers: 1, 3, 5, 7, 9
Two suits of black means 10 odd numbers

d) There are eight outcomes:
$\underline{} \; \underline{} \; \underline{}$
↑ ↑ ↑
2 choices each

$2 \cdot 2 \cdot 2 = 8$

Exactly one tail is THH, HTH or HHT

e) Numbers one apart are:
1,2   2,1
2,3   3,2
3,4   4,3   } 10 pairs
4,5   5,4
5,6   6,5

3. (4pts) The odds against that a certain tree loses its leaves before Nov. 1st are 7-to-5.
a) What is the probability the tree loses its leaves before Nov. 1st?
b) What is the probability the tree doesn't lose its leaves before Nov. 1st?

7 ways it doesn't happen
5 ways it does

a) $\frac{5}{12}$ b) $\frac{7}{12}$

4. (4pts) 36% of all readers' comments on a news website are obnoxious.
a) What are the odds in favor of randomly choosing an obnoxious comment?
b) What are the odds against randomly choosing an obnoxious comment?

36 ways it happens (of 100)
− 64 it doesn't

a) $36:64 = 9:16$
b) $64:36 = 16:9$

5. (12pts) Two dice are rolled. What is the probability that
a) sum is 3 or 8?
b) numbers on the dice are equal or both are odd?
c) at least one of the numbers is even?

a) $P(\text{sum } 3 \text{ OR sum } 8) = P(\text{sum } 3) + P(\text{sum } 8)$ (since they are mutually exclusive)

1,2   2,6
2,1   3,5
        4,4
        5,3
        6,2

$= \frac{2}{36} + \frac{5}{36} = \frac{7}{36} = 0.194444$

b) $P(\text{numbers equal OR both odd}) = P(\text{numbers equal}) + P(\text{both odd}) - P\left(\begin{array}{c}\text{numbers equal AND both odd}\end{array}\right)$

$= \frac{6}{36} + \frac{9}{36} - \frac{3}{36} = \frac{12}{36} = \frac{1}{3}$

1,1   I ⚁   1,1
2,2   3,2
3,3   3 dices each 5,5
4,4   3·3 = 9
5,5
6,6

c) $P(\text{at least one is even}) = 1 - P(\text{both are odd}) = 1 - \frac{9}{36} = \frac{36-9}{36} = \frac{27}{36} = \frac{3}{4}$

6. (10pts) At the KDQ department store, 42% of apparel items are discounted, 13% have been in the store less than a month, and 51% of items are discounted or have been in the store less than a month. What is the probability that a randomly chosen apparel item
a) is discounted and has been in the store less than a month?
b) is not discounted or it hasn't been in the store less than a month?

a) $P(\text{discounted OR} < 1\text{mo}) = P(\text{disc.}) + P(< 1\text{mo}) - P(\text{disc. AND} < 1\text{mo})$

$0.51 = 0.42 + 0.13 - P(\text{disc. AND} < 1\text{mo})$ −0.55

$-0.04 = -P,$ $P(\text{disc. AND} < 1\text{mo}) = 0.04$

b) $P(\text{not disc. OR not} < 1\text{mo}) = 1 - P(\text{disc. AND} < 1\text{mo})$

$= 1 - 0.04 = 0.96$