A list of different kinds of counting and probability problems:

I. How many subsets (total or of size r: 2^n or $C(n,r)$
   a. Forming committees
   b. Choosing a group of a given size

II. What is the smallest size possible for the biggest of m subsets of n objects? $\lceil n/m \rceil$
   a. Pigeonhole principle
   b. Distributing a total to m groups
   c. Selecting enough total of m types to get a minimum number of the same type

III. Ordering elements ($P(n,r)$ or multiplication)
   a. How many orders of a group of distinguishable objects
   b. How many arrangements of a list or seating chart

IV. Selection with replacement, ordered (multiplication)
   a. How many phone numbers?
   b. How many license plates?

V. Ordering with duplicates? (multiplication, divided by permutations of duplicates)
   a. How many distinguishable arrangements of PARROT?

VI. Orders with conditions (multiplication)
   a. Seating order if the first 2 are F and the last 3 are male?
   b. Seating order if the first 2 are F or the last 3 are male?
   c. How many ordered sets of 8 cards if the first card is a heart and the last 2 cards are diamonds?

VII. Choosing a total amount from different types of identical objects ($C(n+t-1,t-1)=C(n+t-1,n)$
   a. Boxes of donuts
   b. Bags of candy/cookies/bagels
   c. Boxes of T-shirts of colors/sizes

VIII. Probabilities (most of the above, but generally not VII)
   a. Subsets (I): probability that 3 counts are heads, or a committee has 2 F
   b. Orders with conditions (probability that first card is a heart, or all cards are in order)
   c. Orders with duplicates (probability that the repeated letters are together)

Answers to review problems

24. a. 2^6 b. $C(6,4)$

25. 12

26. There are 5 flavors of Jolly Ranchers: Grape, Apple, Watermelon, Cherry and Blue Raspberry

a. $C(14,4)=C(14,10)$ b. $5/5^4=1/5^3$ c. $(5\cdot4\cdot3\cdot2)/5^4=24/125$ d. $(1\cdot5\cdot1\cdot1)/5^4=1/5^3$

e. $(1\cdot5\cdot5\cdot5+5\cdot5\cdot1\cdot1-1\cdot5\cdot1\cdot1)/5^4=29/125$ f. 11

27. a. $C(15,5)$ b. $C(7,3)\cdot C(8,2)$ c. $C(7,3)\cdot C(8,2)/C(15,5)$ d. $5!$

e. $(1\cdot4\cdot3\cdot2\cdot1)/(5\cdot4\cdot3\cdot2\cdot1)=1/5$ f. $1/5!$

28. a. $\dfrac{13!}{2!\cdot4!\cdot2!}=64,864,800$ b. $\dfrac{40,320}{64,864,800}=\dfrac{8!\cdot2!\cdot4!\cdot2!}{13!}$