

**problem 7**

I have 100 boxes  $B_1, \dots, B_{100}$   
In how many ways can you

- (a) toss an apple, a pear and an orange into the boxes
- (b) toss an apple, a pear and an orange into the boxes so that no box gets more than one piece of fruit (i.e., no multiple occupancy)
- (c) toss 12 (identical) oranges into the boxes
- (d) toss 12 (identical) oranges into the boxes so that no box gets more than one orange (i.e., no multiple occupancy)

**solution 7**

(a) The fruits are slots. Each can be filled with any of 100 boxes.

Answer is  $100^3$

(b) The fruits are slots again.

Apple can go into any of 100 boxes, pear in any of 99, orange in any of 98.

Answer is  $100 \cdot 99 \cdot 98$

(c) Toss 12 indistinguishable balls into 100 distinguishable boxes.

Can be done in  $\binom{12+100-1}{12}$  ways (stars and bars formula)

(d) Pick the 12 boxes that will each get one orange. Answer is  $\binom{100}{12}$