Math 141

Homework 5.3.50

There are **100** ingots total per bin, **99** good/real and 1 bad/fake.

$$\Pr(detect\ theft\ in\ at\ least\ one\ bin)$$
$$= 1 - \Pr(won't\ detect\ theft\ in\ any\ of\ the\ bins)$$
$$= 1 - [\Pr(won't\ detect\ theft\ in\ one\ bin)]^{number\ of\ bins}$$

Bins checked	Ingots checked per bin	Probability we won't detect theft in one bin	Probability we won't detect theft in any of the searched bins	Probability we will detect theft in at least one searched bin
100	1	$\frac{C(99,1)}{C(100,1)} = \frac{99}{100} = .99$	$(.99)^{100}$	$1 - (.99)^{100} \approx .6340$
50	2	$\frac{C(99,2)}{C(100,2)} = \frac{98}{100} = .98$	$(.98)^{50}$	$1 - (.98)^{50} \approx .6358$
25	4	$\frac{C(99,4)}{C(100,4)} = \frac{96}{100} = .96$	$(.96)^{25}$	$1 - (.96)^{25} \approx .6396$
10	10	$\frac{C(99,10)}{C(100,10)} = \frac{90}{100} = .90$	$(.90)^{10}$	$1 - (.90)^{10} \approx .6513$
1	100	0	$(\ 0\ )^1$	$1 - (\ 0\ )^1 = 1.000$

The specific case of searching 25 bins, 4 ingots per bin:

$$\frac{C(99,4)}{C(100,4)} = \frac{\frac{99 \cdot 98 \cdot 97 \cdot 96}{4 \cdot 3 \cdot 2 \cdot 1}}{\frac{100 \cdot 99 \cdot 98 \cdot 97}{4 \cdot 3 \cdot 2 \cdot 1}} = \frac{99 \cdot 98 \cdot 97 \cdot 96}{100 \cdot 99 \cdot 98 \cdot 97} = \frac{96}{100} = .96$$