24.3

11. A batch of 200 iron rods consists of 50 oversized rods, 50 undersized rods, and 100 rods of the desired length. If two rods are drawn at random without replacement, what is the probability of obtaining **(a)** two rods of the desired length, **(b)** exactly one of the desired length, **(c)** none of the desired length?

a. $\frac{100}{200} = \frac{1}{2}$ $\quad \frac{99}{199} = 0.497 \simeq \frac{1}{2}$ $\quad \frac{1}{4}$

b. Correct $\frac{100}{200} = \frac{1}{2}$ $\quad$ incorrect $\frac{100}{199} = 0.503$ $\quad \frac{1}{4}$

incorrect $\frac{100}{200} = \frac{1}{2}$ $\quad$ correct $\frac{100}{199} = 0.503$ $\quad \frac{1}{4}$

add $\frac{1}{2}$

c. $\frac{100}{200} = \frac{1}{2}$ $\quad \frac{99}{199} \simeq \frac{1}{2}$ $\quad \frac{1}{4}$

13. A pressure control apparatus contains 3 electronic tubes. The apparatus will not work unless all tubes are operative. If the probability of failure of each tube during some interval of time is 0.04, what is the corresponding probability of failure of the apparatus?

$$0.04 + 0.04 + 0.04 = 3(0.04) = 0.12$$

24.4

5. In how many different ways can we select a committee consisting of 3 engineers, 2 physicists, and 2 computer scientists from 10 engineers, 5 physicists, and 6 computer scientists? First guess.

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

$$n! = n(n-1)(n-2)\cdots(1)$$
$$3! = 3(2)(1) = 6$$
$$7! = 7(6)(5)(4)(3)(2)(1) = 5040$$
$$10! = 3628800$$
$$5! = 5(4)(3)(2)(1) = 120$$
$$2! = 2$$
$$4! = 4(3)(2)(1) = 24$$
$$6! = 720$$

engineers

$$\binom{10}{3} = \frac{10!}{3!\,7!} = \frac{3628800}{6(5040)} = 120$$

physicists

$$\binom{5}{2} = \frac{5!}{2!\,3!} = \frac{120}{2(6)} = 10$$

computer scientists

$$\binom{6}{2} = \frac{6!}{2!\,4!} = \frac{720}{2(24)} = 15$$

$$(120)(10)(15) = \boxed{18000}$$

$$\binom{21}{7} = \frac{21!}{7!\,14!} = 116280$$