Let X denote the number of computers in this sample have the defect, $X \sim B(10000, 0.001)$

a) $E(X) = 10000 \times 0.001 = 10$ $\quad \sigma(X) = \sqrt{10000 \times 0.001 \times 0.999} = 3.161$

b) for sample quantity is far more larger than 100,

we assume $X \sim P(10)$ $\quad P(X \geq 10) \approx 1 - 0.583 = 0.417$

c) $P(X=0) = \binom{10000}{0} 0.001^0 \, 0.999^{10000} = 4.517 \times 10^{-5}$

86. a) $P_k(t) = e^{-5t} \cdot (5t)^k / k!$ $\quad P_4(1) = \frac{e^{-5} \cdot 5^4}{4!} = 0.1755$

b) $P(X \geq 4) = 1 - \sum_{i=0}^{3} \frac{e^{-5} \times 5^i}{i!} = 0.7687$

c) $P_k(0.75) = \frac{e^{-3.75} \times 3.75^k}{k!}$ $\quad E(X) = \sum_{x=0}^{\infty} \frac{e^{-3.75} \times 3.75^x}{x!} x$

$= 3.75 \, e^{-3.75} \sum_{x=0}^{\infty} \frac{3.75^x}{x!} = 3.75$

87. a. $P_{10}(2) = \frac{e^{-8} \times 8^{10}}{10!} = 0.09926$

b) $P_0(0.5) = \frac{e^{-2} \times 2^0}{0!} = 0.1353$

c) $\alpha t = 4 \times 0.5 = 2$ Hence 2 calls are expected during the break.

72. a) $x \sim H(6, 4, 11)$ $\quad P(x=4) = \frac{\binom{4}{4}\binom{7}{2}}{\binom{11}{6}} = 0.2727$

b) $E(x) = 6 \times \frac{4}{11} = \frac{24}{11}$

75 a) denote male birth wins $X \sim NB(2, 0.5)$ $\quad P(X=x) = \binom{x+1}{1} 0.5^2 \times 0.5^x = (x+1) 0.5^{2+x}$

b) $P(X=2) = 3 \times 0.5^4 = 0.1875$ $\quad$ c) $P(X \leq 2) = \sum_{x=0}^{2} (x+1) 0.5^{2+x} = 0.6875$

d) $E(X) = \frac{2 \times 0.5}{0.5} = 2$ which is number of male children the family expected to have.
Hence 4 children one the family expected to have.

number of oversized vessels wanted $X \sim Bin(n, 0.6)$

$X \sim Bin(10, 0.6)$; $P(X \geq 6) = \sum_{i=6}^{10} \binom{10}{i} 0.6^i 0.4^{10-i} = 0.6331$

b) $V(X) = 10 \times 0.6 \times 0.4 = 2.4$ $E(X) = 6$

$\sqrt{V(X)} = 1.55$

$P(4.55 \leq X \leq 7.55) = \sum_{i=5}^{7} \binom{10}{i} 0.6^i 0.4^{10-i} = 0.6665$

c) $P(\leq X \leq 7) = 0.8110$

68 a) $X \sim H(6, 12, 20)$

b) $P(X=2) = h(2; 6, 12, 20) = \frac{\binom{12}{2}\binom{8}{4}}{\binom{20}{6}} = 0.1192$

$P(X \leq 2) = \sum_{i=0}^{2} h(i; 6, 12, 20) = 0.1373$

$P(X \geq 2) = 1 - P(X \leq 2) + P(X=2) = 0.9819$

c) $E(X) = \frac{6 \times 12}{20} = 3.6$ $V(X) = \frac{14}{19} \cdot 6 \times \frac{12}{20} \times (1 - \frac{12}{20}) = 1.061$

69. $X \sim H(6, 7, 12)$ a) $P(X=5) = \frac{\binom{7}{5}\binom{5}{1}}{\binom{12}{6}} = 0.1136$

b) $P(X \leq 4) = 1 - P(X=5) - P(X=6) = 0.8788$

c) $E(X) = \frac{6 \times 7}{12} = 3.5$ $V(X) = \frac{6}{11} \times 3.5 \times (1 - \frac{7}{12}) = 0.7955$

$\sqrt{V(X)} = 0.8919$ $P(X \leq 2.6081 \cup X \geq 4.3919) = 0.2424$

d) $\frac{15}{400}$ is a small ratio, we assume $\frac{40}{400}$ as possibility of defectivity

which means we assume $X \sim Bin(15, 0.1)$

$P(X \leq 5) = \sum_{i=0}^{5} \binom{15}{i} 0.1^i 0.9^{15-i} = 0.998$

79. a) $P(X \leq 8) = 0.932$ b) $P(X=8) = 0.932 - 0.867 = 0.065$

c) $P(9 \leq X) = 1 - 0.932 = 0.068$ d) $P(5 \leq X \leq 8) = 0.932 - 0.440 = 0.492$

e) $P(5 < X < 8) = 0.867 - 0.616 = 0.251$

$b(3;8,0.35) = \binom{8}{3} \times 0.35^3 \times 0.65^5 = 0.2786$

b) $b(5;8,0.6) = \binom{8}{5} \times 0.6^5 \times 0.4^3 = 0.2787$

c) $P(3 \le X \le 5) = \sum_{i=3}^{5} \binom{7}{i} \times 0.6^i \times 0.4^{7-i} = 0.7451$

d) $P(1 \le X) = 1 - \binom{9}{0} \times 0.1^0 \times 0.9^9 = 0.6126$

47. a) $B(4;15,0.3) = 0.515$

b) $b(4;15,0.3) = 0.515 - 0.297 = 0.218$

c) $b(6;15,0.7) = 0.015 - 0.004 = 0.011$

d) $P(2 \le X \le 4)$, $X \sim Bin(15,0.3)$ $P = 0.515 - 0.035 = 0.480$

e) $P(2 \le X)$ $X \sim Bin(15,0.3)$ $P = 1 - 0.035 = 0.965$

f) $P(X \le 1)$ $X \sim Bin(15,0.7)$ $P = 0.000$

g) $P(2 < X < 6)$ $X \sim Bin(15,0.3)$ $P = 0.722 - 0.127 = 0.593$

48 a. $P(X \le 2) = \sum_{i=0}^{2} \binom{25}{i} (5\%)^i (95\%)^{25-i} = 0.8729$

b) $P(X \ge 5) = 1 - \sum_{i=0}^{4} \binom{25}{i} 0.05^i \, 0.95^{25-i} = 0.0072$

c) $P(1 \le X \le 4) = \sum_{i=1}^{4} \binom{25}{i} 0.05^i \, 0.95^{25-i} = 0.7155$

d) $P(X=0) = \binom{25}{0} 0.05^0 \, 0.95^{25} = 0.2774$

e. $E(X) = 25 \times 0.05 = 1.25$ $D(X) = 25 \times 0.05 \times 0.95 = 1.1875$