week 5

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1) · bus arrives every 10 min
· Waiting time for paticular individual is a random variable with continuos variable with continuos uniform distribution

a) what is the probability that the individual waits more than 7 min?

$$f(x; A, B) = \begin{cases} \frac{1}{B-A}, & A \leq x \leq B \\ 0 & \text{elsewheres} \end{cases}$$

$$F(x; 0, 10) = \begin{cases} \frac{1}{10}, & 0 \leq x \leq 10 \\ 0 \end{cases}$$

$$P[X \geq 7] = \int_7^{10} \frac{1}{10}\, dx = \left(\frac{1}{10}\right)(x) \Big|_7^{10}$$

$$\left(\frac{1}{10}\right)[10 - 7] \Rightarrow \left(\frac{1}{10}\right)(3) = \frac{30}{100} = \boxed{\frac{1}{3}}$$

b) what is the prob waits between 2 & 7 min?

$$P[2 \leq X \leq 7] = \int_2^7 \frac{1}{10}\, dx \Rightarrow \frac{1}{10}[x] \Big|_2^7$$

$$\boxed{\frac{1}{10}[7 - 2] = \left(\frac{1}{10}\right)(5) = \frac{50}{100} = \boxed{\frac{1}{2}}}$$

2) Average length 30 centimeters
Standard deviation 2 centimeters

normally distributed, what percentage of the loaves are:

a) longer than 31.7 centimeters?

$$z = \frac{x - \mu}{\sigma}$$

$\mu = 30$ centimeters
$\sigma = 2$ centimeters

$$z = \frac{31.7 - 30}{2} \Rightarrow 0.85$$

$P(X > 31.7) = P(Z > 0.85) = 1 - P(z < 0.85) =$

* from Table A.3 page 736 $z \Rightarrow 0.85 = 0.8023$

$P(X > 31.7) = 1 - 0.8023 = \boxed{0.1977 \approx 0.2 \approx 20\%}$

B) Beetween 29.3 & 33.5 centimeters in length?

$x_1 = 29.3$ $x_2 = 33.5$

$z_1 = \frac{29.3 - 30}{2} = -0.35$ $z_2 = \frac{33.5 - 30}{2} = 1.75$

$P(29.3 < X < 33.5) = P(-0.35 < Z < 1.75) =$
$P(Z < 1.75) - P(Z < -0.35) = (0.9599 - 0.3632) =$

$P(z < 1.75) = 0.9599$
$P(z < -0.35) = 0.3632$

$$\boxed{0.5967 \approx 0.597 \approx 60\%}$$

3) mean = 99.61

Standard deviation = 0.08

Distribution of percent purity was approx normal

a) what % of the purity would expect to be between 99.5 & 99.7?

$X_1 = 99.5$ $\quad$ $X_2 = 99.7$

$z_1 = \frac{99.5 - 99.61}{0.08}$ $\quad$ $z_2 = \frac{99.7 - 99.61}{0.08} =$

$z_1 = -1.375$

$z_2 = 1.125$

$P(99.5 < X < 99.7) = P(-1.375 < z < 1.125) =$

$P(z < 1.125) - P(z < -1.375) \approx (0.8697 - 0.0846) =$

Note* ⇒ calculated values using $\underline{R}$

$\boxed{0.7851} =$

$\boxed{78.51\%}$

b) what purity value would expect to exceed 5% of poplatron?

* Any thing greater than 5%

$X = 5\% = 0.05$

$P(X > x) = 0.05$

$1 - P(X \le x) = 0.05 \Rightarrow P(X \le x) = 0.95$

$P\left(z_{Big} \le z_{small}\right) = 0.95$

$P\left(z \le \frac{x-\mu}{\sigma}\right) = 0.95$

$P(z \le 1.645) = 0.95$

Note: Page #36

Values of
$z = 1.64 = 0.9495$ $\pm 10^{-2}$
$z = 1.65 = 0.9505$

* increments of 10^{-2}, thus midway should make it more accurate.
$1.645 = 0.95$

$z = \frac{(X - \mu)}{\sigma}$

$(z)(\sigma) + \mu = X$

$(1.645)(0.08) + 99.61 = X$

$\boxed{X = 99.74}$

4) Failure rate = 0.01 per hr
* exponential distribution applies

a) what is mean time to failure?

μ = 1 failure per 0.01 hr $= \frac{1}{0.01} = \boxed{100 \text{ hrs}}$

b) what is the prob that 200 hrs will pass a failure before a failure is observed?

* from page 196

The prob that the length of time until the first event will exceed x is the same as the prob that no Poisson event will occurs in x

The cumulative distribution for X is:

$$P(0 \le X \le x) = 1 - e^{-\lambda x}$$

* page 197 $\lambda = 1/\beta$

$$P(X \ge 200) = 1 - P(X \le 200)$$
$$= 1 - (1 - e^{-(0.01)(200)})$$
$$= 1 - (1 - 0.135)$$
$$= 1 - 0.864$$

$P(X \ge 200) = 0.135$

$P(X \ge 200) = 13.5\%$