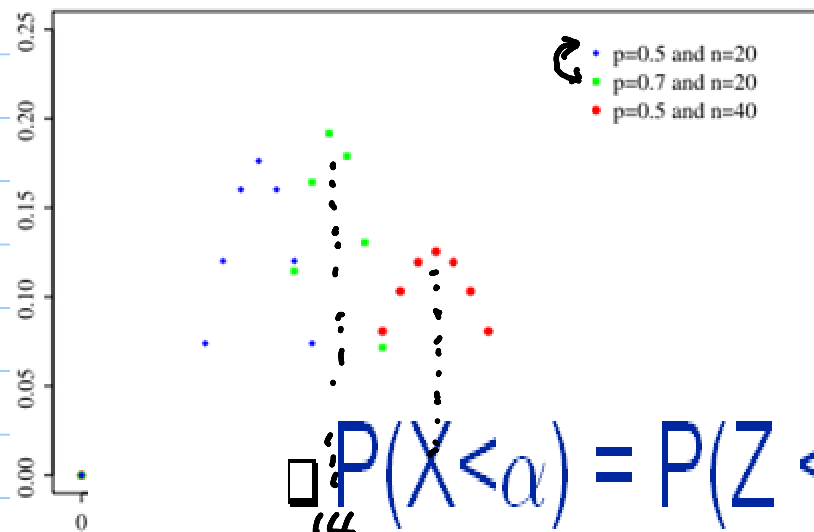
Note 8/28/2012

$$P(X=k) \equiv f(k;n,p) = \binom{n}{k} p^k (1-p)^{n-k}$$

$p(AB) = p(A) \cdot p(B)$ when A, B independ



$E[X] = n \times p$

$p(Q) = P(\le e$ bit error in n bit trials$)$

$= P(X=0) + p(X=1) + \dots + p(X=e)$

r.v. X: # of error bits in n bits transmission

$$P(X<\alpha) = P(Z < (\alpha-\mu)/\sigma)$$

$$= \Phi((\alpha-\mu)/\sigma)$$

- 1 Mb/s link
- each user:
  - 100 kb/s when "active"
  - active 10% of time

$n = 35$ r.v. X : # of active user at a moment

$X \sim B(n, p)$
$\sim B(35, 0.1)$

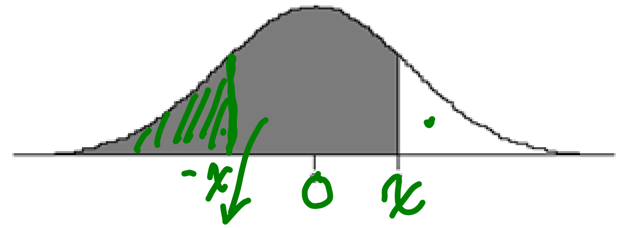
$P(\text{congestion}) = P(\text{more than 10 users active})$
$= P(X > 10)$
$= P(X=11) + P(X=12) + P(X=13) + \cdots + P(X=35)$
≈ 0.0004

$Z = \frac{X-\mu}{\sigma}$

- $P(X<\alpha) = P(Z < (\alpha-\mu)/\sigma)$
$= \Phi((\alpha-\mu)/\sigma)$

$P(X<\alpha) = P(Z\sigma + \mu < \alpha)$
$= P(Z\sigma < \alpha - \mu)$
$= P(Z < \frac{\alpha-\mu}{\sigma})$

x	F(x)	x	F(x)	x	F(x)
-2.5	0.006	-1	0.159	0.5	0.691
-2.4	0.008	-0.9	0.184	0.6	0.726
-2.3	0.011	-0.8	0.212	0.7	0.758
-2.2	0.014	-0.7	0.242	0.8	0.788
-2.1	0.018	-0.6	0.274	0.9	0.816
-2	0.023	-0.5	0.309	1	0.841
-1.9	0.029	-0.4	0.345	1.1	0.864
-1.8	0.036	-0.3	0.382	1.2	0.885
-1.7	0.045	-0.2	0.421	1.3	0.903
-1.6	0.055	-0.1	0.46	1.4	0.919
-1.5	0.067	0	0.5	1.5	0.933
-1.4	0.081	0.1	0.54	1.6	0.945
-1.3	0.097	0.2	0.579	1.7	0.955
-1.2	0.115	0.3	0.618	1.8	0.964
-1.1	0.136	0.4	0.655	1.9	0.971

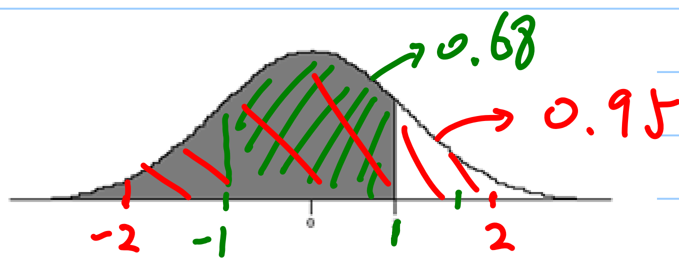


$P(Z < x)$

$P(Z < -x) = P(Z > x)$

$P(Z > x) + P(Z \leq x) = 1$

$\Rightarrow P(Z \leq -x) + P(Z \leq x) = 1$



6 feet ± 6 inches