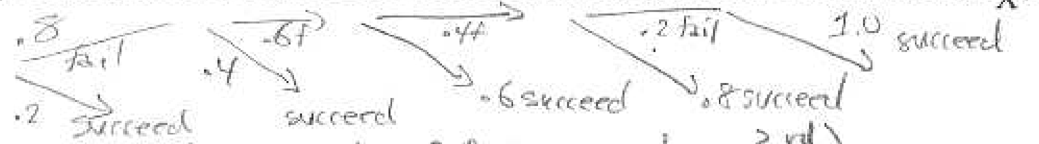
ECEN4503 Quiz #2 26 January 2011 Name Solution

1) Experience typically increases the P(success) of some task. Suppose an experiment consists of some independent trials where the subject repeats the trial until they succeed, at which point the experiment is over. The P(success | trial n) = 0.2n. Hence the P(success | trial 1) = 0.2, P(success | trial 2) = 0.4, etc. Five trials is the max since success is guaranteed on the fifth trial.

[2] **Compute** the P(success on or before the 3rd trial).

[3] Define a random variable X to be the trial in which success occurs. **Sketch** $f_X(x)$.

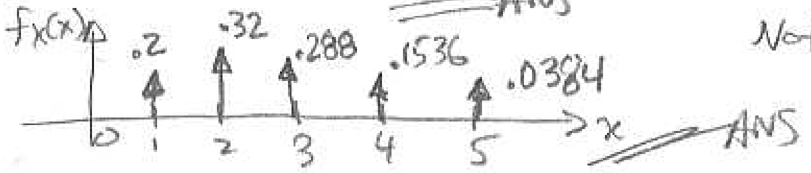


P(succeed on 1st + succeed on 2nd + succeed on 3rd)

= P(succeed on 1st) + P(succeed on 2nd) + P(succeed on 3rd) − 0 (Mutually Exclusive events)

= P(succeed on 1st) + P(fail on 1st) P(succeed #2 / fail 1st) + P(fail on 1st) P(fail 2nd / fail 1st) P(succeed 3rd / fail 2nd)

$= .2 + .8(.4) + .8(.6)(.6) = \underline{\underline{.808}}$ ANS

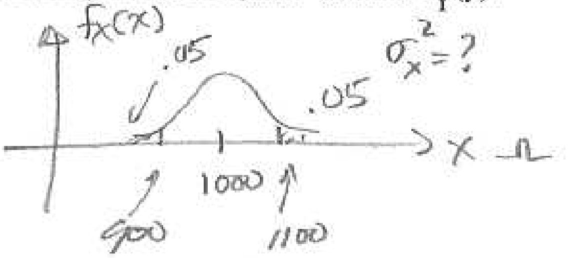


Note: $\int_{-\infty}^{\infty} f_X(x)\,dx = 1$

2) Define a random variable X to be a resistor's value in ohms. A manufacturing process generates 1,000 ohm resistors with P(900 < X < 1100) = 0.9. Assume the resistor values are Gaussian distributed with a mean of 1,000 ohms.

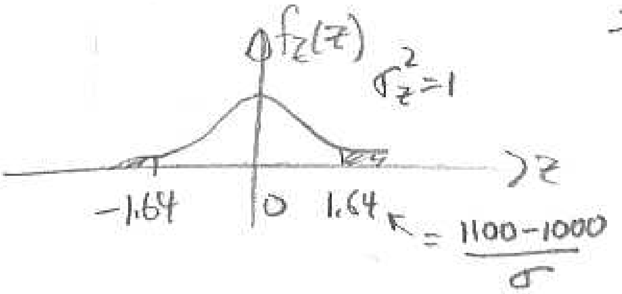
[3] **Compute** the standard deviation σ.

[2] You grab two resistors at random. Define Y = the number of these two resistors that are within ± 100Ω of 1,000. **Sketch** $f_Y(y)$.



Want $P(X > 1100) = .05$

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



$\Rightarrow$ Want $P\left(Z > \frac{1100-1000}{\sigma}\right) = .05$

$1 - P\left(Z < \frac{100}{\sigma}\right) = .95$

$1 - F(1.64) = .95 \Rightarrow \frac{100}{\sigma} = 1.64$

$\sigma = \underline{\underline{60.98\ \Omega}}$ ANS

Y is binomial

$\theta = .9$