You may keep this list of questions. Turn in all of your work with your answers on the colored paper.

(1) 20 Points.
(a) Find $P(0.147 \leq T \leq 0.518)$, if $T$ has a $t$-distribution with 81 degrees of freedom.
(b) Find $\chi^2_{0.02}$ for a Chi-Square distribution with 250 degrees of freedom.
(c) Find $f_{0.80}$ for an $F$-distribution with 75 and 100 degrees of freedom.
(d) If $X$ has a normal distribution with mean $\mu_X = 48.50$ and variance $\sigma^2_X = 36.00$, find $P(X \geq 55.00)$.

(2) 10 Points. In a photographic process, the developing time of prints may be looked upon as a random variable having the normal distribution with a mean of 16.472 seconds and a standard deviation of 0.131 seconds. Find the probability that it will take anywhere from 16.30 seconds to 16.60 seconds to develop one of the prints.

(3) 10 Points. If $X$ normal distribution with mean $\mu_X = 128.7$ and variance $\sigma^2_X = 14.80$, find the probability that a random sample of size 160 from $X$ will have a sample variance $s^2_X$ that is at least as large as 15.65.

(4) 10 Points. Suppose that $X$ and $Y$ are independent random variables with $E(X) = 4.0$, $E(Y) = 3.0$, $\Var(X) = 8.0$, and $\Var(Y) = 15.0$. Find the expected value of $W$ and the variance of $W$ if $W = 17 - 8X + 3Y$.

(5) 20 Points. The random variable $X$ has the following density function:

$$f(x) = \begin{cases} \frac{k}{2} \cos(\pi x) & \text{if } \frac{1}{2} < x < \frac{1}{2} \\ 0 & \text{elsewhere} \end{cases}$$

(a) Find the value of $k$.
(b) Find $P(-\frac{1}{4} \leq x \leq \frac{1}{4})$.

(6) 20 Points. Suppose that $X$ and $Y$ have the continuous joint density function given by

$$f(x, y) = \begin{cases} \frac{3}{4} (x - y) & \text{if } x \leq 2, y \geq 0 \text{ and } y \leq x \\ 0 & \text{elsewhere} \end{cases}$$

(a) Find the marginal density function $f_1(x)$ for $X$.
(b) Find $P(Y \geq 1)$.

(7a) 5 Points. State Chebyshev’s Theorem.
(7b) 5 Points. Write a brief essay discussing both the usefulness of Chebyshev’s Theorem and its limitations.