0.1 Formulas for exam #1

Fourier series:

$$\begin{aligned}
a_k(f) =& \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos(kx)\,dx \\
b_k(f) =& \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin(kx)\,dx \\
c_k(f) =& \frac{1}{2\pi}\int_{-\pi}^{\pi} f(x)e^{-ikx}\,dx \\
\frac{1}{2\pi}\int_{-\pi}^{\pi} |f(x)|^2\,dx =& \sum_{k=-\infty}^{\infty} |c_k|^2 \\
=& |a_0|^2 + \frac{1}{2}\sum_{k=1}^{\infty} |a_k|^2 + |b_k|^2 \\
\frac{\mathrm{Si}\,(\pi)}{\pi} - \frac{1}{2} \approx& 0.0895
\end{aligned}$$

From a table of integrals:

$$\begin{aligned}
\int x^2\cos(kx)\,dx =& \frac{2x\cos(kx)}{k^2} + \frac{\left(k^2x^2-2\right)\sin(kx)}{k^3} + C \\
\int x^2\sin(kx)\,dx =& \frac{2x\sin(kx)}{k^2} - \frac{\left(k^2x^2-2\right)\cos(kx)}{k^3} + C
\end{aligned}$$

Common discrete probability distributions

$$p_X(k) = \begin{cases} 1/N & \text{if } k = 1, 2, \ldots, N \\ 0 & \text{else} \end{cases}$$

$$p_X(k) = \begin{cases} p & \text{if } k = 1 \\ 1-p & \text{if } k = 0 \\ 0 & \text{else} \end{cases}$$

$$p_X(k) = \begin{cases} \binom{n}{k} p^k (1-p)^{n-k} & \text{if } k = 0, 1, \ldots, n \\ 0 & \text{else} \end{cases}$$

$$p_X(k) = \begin{cases} e^{-\lambda}\lambda^k/k! & \text{if } k = 0, 1, 2, \ldots \\ 0 & \text{else} \end{cases}$$