Task 1. Calculate $\Pr(X(1)Y(2)Z(3) = 4)$ when $X(t)$, $Y(t)$ and $Z(t)$ are independent Poisson processes with intensity/rate 1. **(5 points)**

Task 2. Let $\{X(t)\}_{t\geq 0}$ be a zero-mean Gaussian process with autocorrelation function $R_{XX}(s,t) = \min(s,t)$. What probability distribution has $Y = X(1) + \int_0^1 X(s)\,ds$?

(5 points)

Task 3. Let $\{X_k\}_{k=0}^{\infty}$ be a Markov chain with state space $\{0,1,2\}$, initial distribution $\pi(0) = (1\ 0\ 0)$ and all transition probabilitites $p_{ij} = 1/3$. Calculate $\mathbf{E}\{T\}$ for $T = \min\{k > 0 : X_k = 2\}$. **(5 points)**

Task 4. A continuous time LTI system with insignal $X(t)$ has outsignal $Y(t) = \int_{-\infty}^{\infty} X(t-s)\,\frac{1}{1+s^2}\,ds$. What is the transfer function $H(f)$ of the system? **(5 points)**

Task 5. Let $Y(t) = \mathrm{e}^{-t/2}X(\mathrm{e}^t)$ for $t \in \mathbb{R}$ where $X(t)$ is the process in Task 2. Show that $Y(t)$ is a stationary process. **(5 points)**

Task 6. Explain how an AR(1) process $\{X_k\}_{k=-\infty}^{\infty}$ can be viewed as the limit of an n'th order MA process [i.e., MA(n) process] as $n \to \infty$.