## MSO205 PRACTICE PROBLEMS SET 11

*Question 1*. Let $X$ and $Y$ be i.i.d. $N(0,1)$ RVs. Identify the distribution of $\frac{X}{Y}$ and $\frac{X}{|Y|}$.

*Question 2*. Let $X \sim F_{m,n}$. Identify the distribution of $\frac{n}{n+mX}$.

*Question 3*. Let $X$ and $Y$ be i.i.d. $Exponential(\lambda)$ RVs, for some $\lambda > 0$. Identify the distribution of $\frac{X}{Y}$.

*Question 4*. Let $Y \sim N_p(b, K)$. Then for any $c \in \mathbb{R}^n$ and a $n \times p$ real matrix $B$, consider the $n$ dimensional random vector $Z = c + BY$. Show that $Z \sim N_n(c + Bb, BKB^t)$.

*Question 5*. Let $X$ be a $p$-dimensional random vector, $a \in \mathbb{R}^m$ and $A$ be an $m \times p$ real matrix. Then show that the Characteristic function of the $m$-dimensional random vector $Y = a + AX$ given by

$$\Phi_Y(u) = \exp(iu^t a)\, \Phi_X(A^t u), u \in \mathbb{R}^m.$$

*Question 6*. Show that $\mathbb{E}|X|^\alpha < \infty, \forall \alpha \in (0,1)$ when $X \sim Cauchy(0,1)$.