1) Write down a generic algorithm for computing the Cholesky decomposition of a positive definite, symmetric matrix $\Omega$.

2) Let

$$
\begin{align*}
y_i^* &= X_i\beta + u_i, \\
u_i &\sim iidN(0,1), \\
y_i &= 1 (y_i^* > 0), \\
i &= 1, 2, …, n.
\end{align*}
$$

Let $\hat{\beta}$ be the probit estimator of $\beta$.

a) Explain why it would be inappropriate to simulate the mean of $\hat{\beta}$.

b) Describe in great detail how to simulate the median of $\hat{\beta}$.

3) You have just estimated a model of the form,

$$
y_i = g (X_i, \theta, u_i), \ i = 1, 2, …, n
$$

with $u_i \sim iidF$. Now using your model and using your estimates of $\theta$. You want to predict

$$
\int \frac{\partial E y_i}{\partial X_{ij}} f(X_i) dX_i
$$

where $X_{ij}$ is an exogenous variable in your model and $f(X_i)$ is the joint density of $X_i$. You can assume that you have estimates of $f(X_{i1})$, $f(X_{i2} | X_{i1})$, …, $f(X_{iJ} | X_{i1}, …, X_{i,J-1})$.

a) Describe in detail how to do this.

b) Describe in detail how to simulate the variance of your estimate due to variance in your estimate of $\theta$. 
