You are interested in measuring the effect of sex education on sexual behavior. You are given a large sample of data. For a large number of teens, you observe some continuous measure of sexual activity, the amount and type of sex education received and some other child, family, and environmental characteristics. You observe multiple members from the same family and, for each person, you observe them for multiple periods.

1) Write down a model allowing for person effects and family effects. Discuss the advantages and disadvantages of treating each effect as a fixed effect or a random effect.

2) Assuming that the person and family effects are random and the idiosyncratic effect (varying over time, person, and family) is serially correlated, construct the covariance matrix of the total error.

3) It is suggested that sex education has a bigger effect on blacks than whites and on girls than boys. Suggest how to test this using a Lagrange Multiplier test. What problems would arise in implementing your test if the person and family effects are correlated with the sex education variable?