1. Consider the following situation. A firm is managed by two individuals: Ann and Bill. Claudia has applied for a job with the firm. The application first goes to Ann, who can either veto it, in which case Claudia will not be hired, or approve it, in which case Claudia will be hired. Ann can also decide not to do any of the above and forward the file to Bill, asking him to make the hiring decision. In this case Bill can either hire Claudia or not hire her. If Claudia is hired, she is not told who made the hiring decision. If Claudia is hired, she can either work hard or shirk. The rankings of the outcomes are as follows. Claudia's favorite outcome is to be hired by Bill and shirk (she used to be in love with him and he rejected her!). The next best outcome is to be hired by Ann and shirk. The least favorite outcome is to be hired by Bill and work hard. Of the remaining outcomes, her most preferred is the one where she is hired by Ann and works hard and her least preferred is the one where Bill made the decision not to hire her; the remaining outcome is ranked between these two. Each of the two managers has the following preferences. The best outcome is one where he/she made the decision to hire Claudia and Claudia works hard (the hiring manager gets the credit for making a good hiring decision). The least favorite outcome is one where the other manager hired Claudia and she works hard (the other manager will get the credit). The outcome immediately above this (i.e. second to last) is the one where he/she made the decision to hire Claudia and Claudia shirks (he/she will take the blame for making a bad hiring decision). Of the remaining outcomes, his/her most favorite is the one where Claudia was hired by the other manager and shirks (the other manager will be blamed for making a bad decision and he/she will be able to take advantage of it). If Claudia is not hired, each manager prefers the other manager to have made the decision (no feelings of guilt).

(a) Draw an extensive game to represent this situation. Use a utility function to represent payoffs, by assigning the value 5 to the best outcome and the value 0 to the worst (and values 1, 2, 3 and 4 to the others).

(b) Write the corresponding strategic form and find the Nash equilibria.

(c) Are any of the Nash equilibria not subgame perfect?
Two investors have each deposited $120 in a bank. The bank has invested these deposits in a long-term project. If the bank is forced to liquidate the investment before the project matures, a total of $180 can be recovered. However, if the bank allows the investment to reach maturity, the project will pay out a total of $320.

There are two dates at which the investors can make withdrawals from the bank: date 1, before the bank’s investment matures, and date 2, after its maturity. If both investors make withdrawals at date 1 then each receives $90 and the game ends. If only one investor makes a withdrawal at date 1 then that investor receives $120, the other receives $60, and the game ends. If neither investor makes a withdrawal at date 1 then this fact becomes common knowledge, the project matures and the investors make withdrawal decisions at date 2. If both investors make withdrawals at date 2 then each receives $160. If only one investor makes a withdrawal at date 2 then that investor receives $220 and the other receives $100. Finally, if neither investor makes a withdrawal at date 2 then the bank returns $160 to each investor. At each date the decision whether or not to make a withdrawal is made simultaneously by both investors.

Assume that each investor is selfish and greedy.

a) Represent this game in extensive form.

b) How many subgames are there?

c) Find the pure-strategy subgame-perfect equilibria.

d) Convert the original extensive game (of part a) into a strategic-form game.

e) Find all the pure-strategy Nash equilibria of the game.

f) Are all the pure-strategy Nash equilibria subgame perfect?