MATH1320 Assignment 1 (Worth 5%)

Due date: Friday, 27 March, 2020

1. This is a two–person game where Player 1, the plaintiff, alleges that Player 2, the defendant, is guilty of not providing adequate safeguard at an industrial plant. The plaintiff has no way of being certain that this is the case, whereas the defendant *knows* whether he is guilty as charged. The plaintiff can either ***Sue*** or take ***No Action***. In return, the defendant can either ***Hold Out*** or ***Offer*** to settle out-of-court. If the defendant offers to settle, then the plaintiff can either ***Settle*** or he could ***Refuse***, in which case the proceeding goes to ***Trial***. If the defendant holds out, then the plaintiff can ***Try*** the case, resulting in the proceeding going to trial, or he can ***Drop*** it.

   The extensive form of the game is displayed in the tree diagram over the next page. Note that the root of the tree is a move by Nature, labelled 0, who determines whether the defendant is guilty or not guilty of the charge of negligence. The following are the costs associated with this game.

- *S = settlement amount*
- *W = damages*
- *δ = court cost for defendant*
- *π = court cost for plaintiff*

Also, we let Pr(defendant guilty) = q and therefore Pr(defendant is innocent) = 1 − q.

It will be assumed that if the case reaches the court, justice is done. In addition to his legal fee δ, the defendant pays the damages W only if he is guilty.

(a) Explain the information sets surrounding Player 1's nodes.

(b) Display the strategic (normal) form of the game.

(**Hint:**

- Since taking *no action* will terminate the game right from the outset, you can group all the pure strategy combinations with this action into one: (*no action*).
- To evaluate players' payoffs, refer the following example:

  If Player 1 selects (*Sue; refuse, try*) and Player 2 selects (*hold out*, *offer*) then

  - Player 1 sue.
  - If Player 2 is innocent, he will *hold out* and Player 1 will *try* the case with corresponding payoffs $(-\pi, -\delta)$.
  - If Player 2 is guilty, he *offer* to settle and Player 1 will *refuse* with corresponding payoffs $(W-\pi, -W-\delta)$.
  - The expected payoffs are therefore

$$q(W-\pi, -W-\delta) + (1-q)(-\pi, -\delta)$$
$$= (q(W-\pi) - (1-q)\pi, -q(W+\delta) - (1-q)\delta).$$

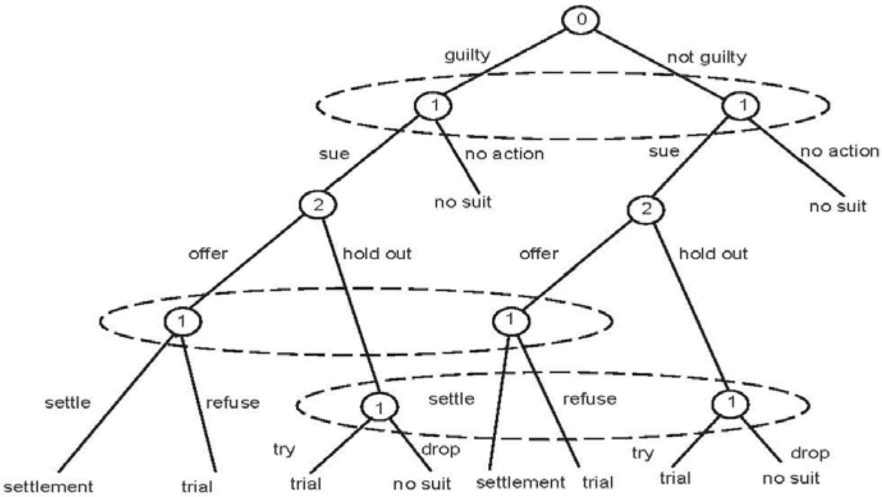

Figure 1: Extensive form of game

2. Two internet users need to transfer large files across the network at the same time. The files could be compressed or left uncompressed before they are transferred. Each uncompressed file places a load on the network which is 65% of its capacity while a compressed file only places a load of 20% on the network. If both users transfer uncompressed files, then the total offered load on the network would be larger than its capacity, i.e. 130%, which will result in severe disruption of file throughput. The network will be able to cope if one or more users compress their files before transfer resulting in a total offered load to the network of 85% or 40% respectively. However, the transmission time of compressed files will be delayed since compression takes time and uncompressed files are transferred before the compressed ones.

We assign the following actions

$$c = compress\ file \quad and \quad \bar{c} = \ don't\ compress\ file$$

to the user. The payoffs of the various outcomes are:

- if both users take the same action , i.e., to compress or not to compress their files, then they will each get the payoff
$$a_{ii} = \frac{1}{6}(100 - total\ offered\ load) - \ T_{ii}$$
where $T_{cc} = 7$ *and* $T_{\bar{c}\bar{c}} = 5$. Also, *total offered load = 100 × capacity.*

- if one user compressed his file while the other one didn't, then the one who did gets 0 while the one who didn't gets the payoff given by the above equation but with $T_{c\bar{c}} = -2.5$.

Task: Express the above game in strategic (normal) form.

(15 + 5 = 20 marks)