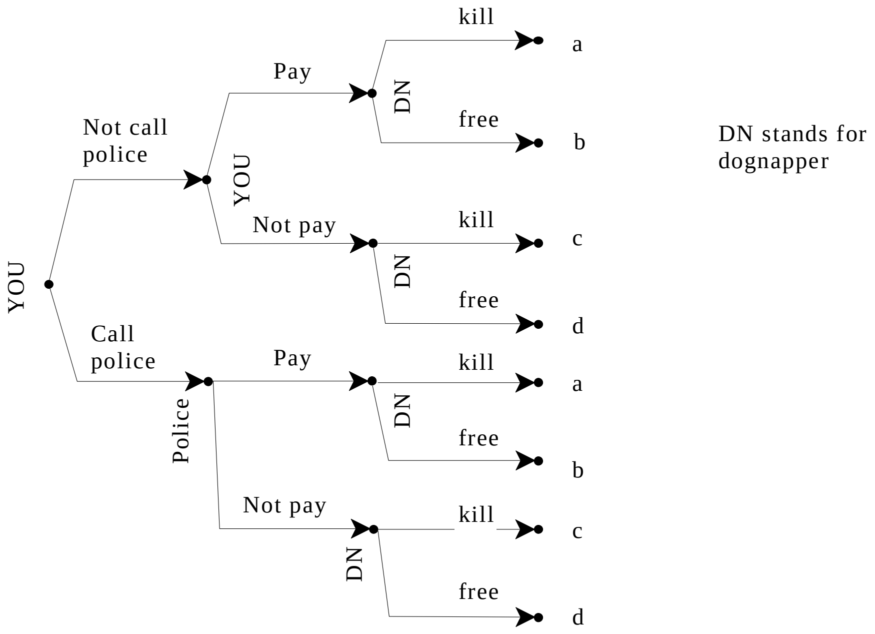
Department of Economics, University of California, Davis
Ecn 200C – Micro Theory – Professor Giacomo Bonanno

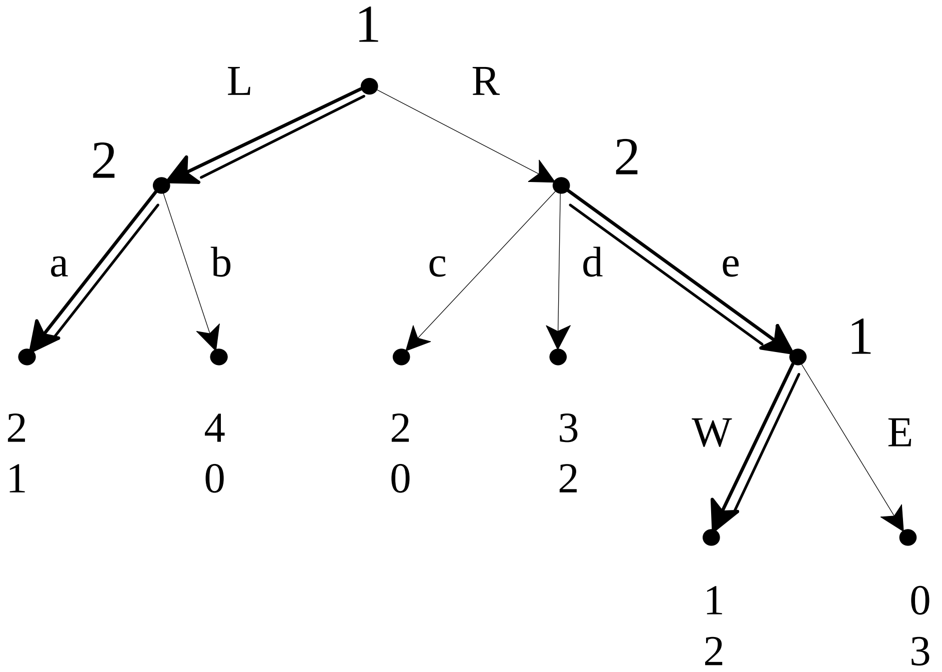
ANSWERS TO PRACTICE PROBLEMS $\boxed{9}$

1. All the three extensive games have the following structure:

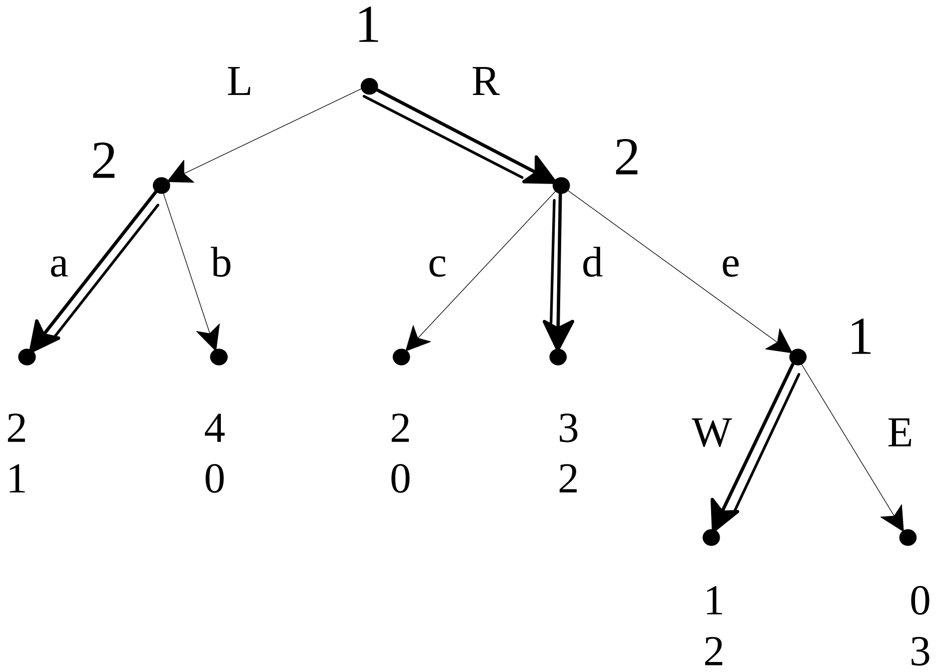


The only difference lies in how the dognapper ranks the four outcomes a, b, c and d. Against the Nice freelance, you will either not call the police, not pay and get your Barky back or you will call the police, who will not pay and get you your Barky back. Against the Nasty freelance, you will either not call the police, not pay and never see Barky again, or you will call the police, who will not pay and you will never see Barky again. Against the professional you will not call the police, pay and get your Barky back.

2. **(a)** One backward-induction solution is: player 1 chooses L and W and player 2 chooses a and e. This is shown in the following figure.



The other backward-induction solution is: player 1 chooses R and W and player 2 chooses a and d. This is shown in the following figure.



(b) Player 1 has four strategies are: LW, LE, RW, RE.

(c) Player 2 has six strategies: ac, ad, ae, bc, bd, be.

(d) The normal form is as follows:

2

		ac	ad	ae	bc	bd	be
1	LW	2 , 1	2 , 1	2 , 1	4 , 0	4 , 0	4 , 0
	LE	2 , 1	2 , 1	2 , 1	4 , 0	4 , 0	4 , 0
	RW	2 , 0	3 , 2	1 , 2	2 , 0	3 , 2	1 , 2
	RE	2 , 0	3 , 2	0 , 3	2 , 0	3 , 2	0 , 3

(e) Player 1 does not have a dominant strategy.

(f) For Player 2 ae is a weakly dominant strategy.

(g) There is no dominant strategy equilibrium.

(h) For Player 1 RE is weakly dominated by RW (and LW and LE are equivalent to each other).

(i) For Player 2 *ac* is weakly dominated by *ad* (or *ae*), *ad* is weakly dominated by *ae*, *bc* is (strictly or weakly) dominated by every other strategy, *bd* is weakly dominated by *be* (and by *ae* and *ad*), *be* is weakly dominated by *ae*. Thus the dominated strategies are: *ac*, *ad*, *bc*, *bd* and *be*.

(j) The iterative elimination of weakly dominated strategies yields the following reduced game(first eliminate RE for player 1 and *ac*, *ad*, *bc*, *bd* and *be* for player 2; then eliminate RW for player 1:

	ae
LW	2 , 1
LE	2 , 1

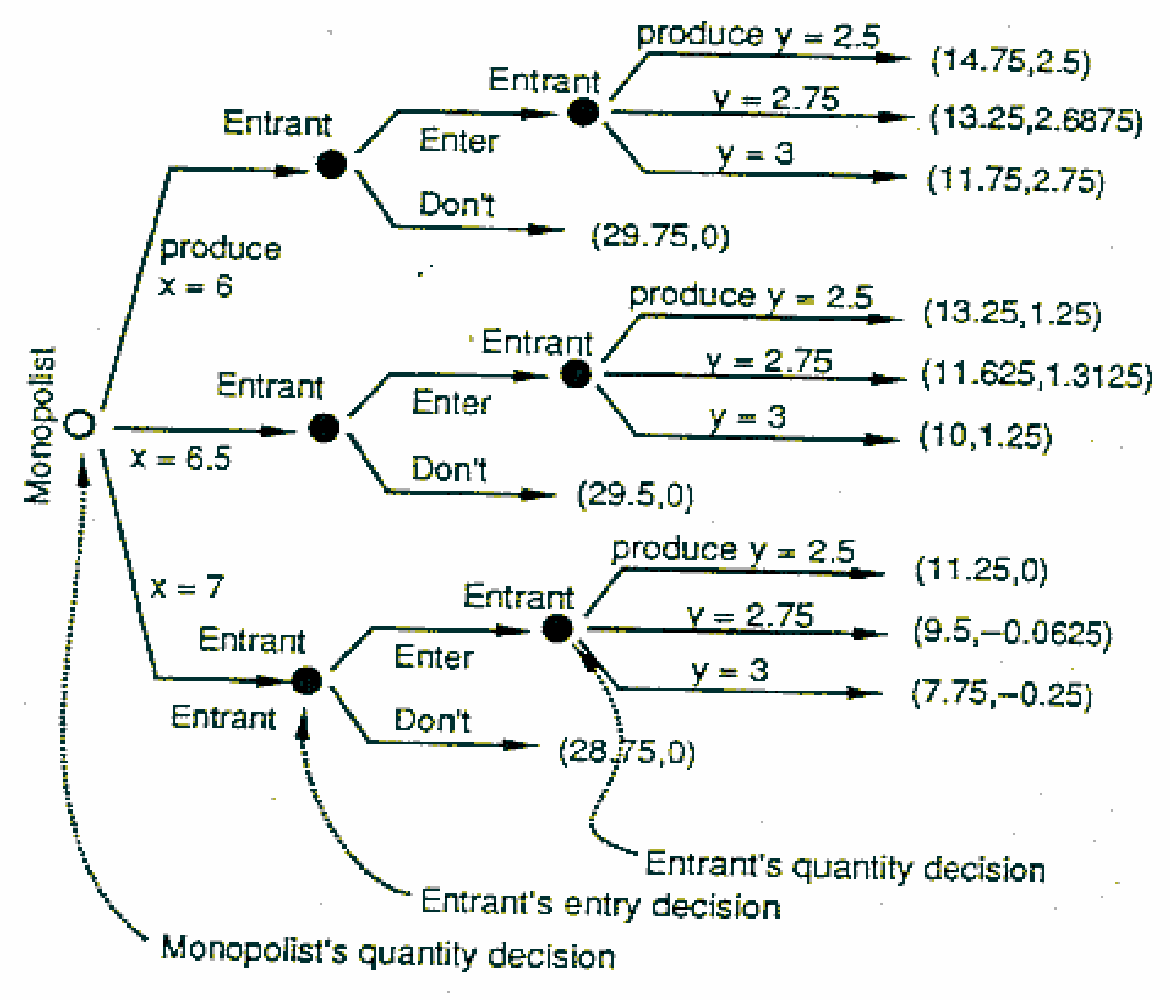
Thus we are left with one of the two backward-induction equilibria ((LW,ae)) and also with (LE,ae) which is not a backward-induction equilibrium.

(k) The Nash equilibria are highlighted in the following table. There are five Nash equilibria: (LW,ac), (LE,ac), (RW,ad), (LW,ae) and (LE,ae).

2

		ac	ad	ae	bc	bd	be
1	LW	2 , 1	2 , 1	2 , 1	4 , 0	4 , 0	4 , 0
	LE	2 , 1	2 , 1	2 , 1	4 , 0	4 , 0	4 , 0
	RW	2 , 0	3 , 2	1 , 2	2 , 0	3 , 2	1 , 2
	RE	2 , 0	3 , 2	0 , 3	2 , 0	3 , 2	0 , 3

3. **(a)** The numbers given at the terminal nodes are the profits of incumbent and entrant, respectively. For example, if the incumbent chooses x = 6 and the entrant enters and chooses y = 3, then total industry output is 9, price is 4, incumbent's revenue is 4(6) = 24, her cost is 6.25 +6 = 12.25, hence her profits are 24 − 12.25 = 11.75. The entrant's revenue is 3(4) = 12, his cost 3 + 6.25 = 9.25 and hence his profit 12 − 9.25 = 2.75. Similarly for the other cases.



(b) The backward induction solution is as follows: if the incumbent chooses $x = 6$ then the entrant will enter and produce $y = 3$, leaving the incumbent with a profit of 11.75; if the incumbent chooses $x = 6.5$ then the entrant will enter and produce $y = 2.75$, leaving the incumbent with a profit of 11.625; if the incumbent chooses $x = 7$ then the entrant will stay out (he cannot make positive profits by entering), leaving the incumbent with a profit of 28.75. Thus the incumbent will choose $x = 7$, thereby deterring entry.

(c) The incumbent has three strategies.

(d) The potential entrant has six decision nodes, two choices at three of those and three choices at the other three. Thus he has $2^3(3^3) = 216$ strategies. One possible strategy is enter and produce $y = 2.5$ no matter what. Another one is: if $x = 6$, stay out but if entered then $y = 3$, if $x = 6.5$ enter and choose $y = 2.5$, if $x = 7$ stay out but if entered then $y = 3$. Of course this latter strategy contains a lot of redundancies.

(e) The following is a Nash equilibrium. Incumbent's strategy: $x = 6$. Potential entrant's strategy: if $x = 6$, enter with $y = 3$, if $x = 6.5$ enter with $y = 3$, if $x = 7$ enter with $y = 3$ (that is, enter with $y = 3$ no matter what). This equilibrium gives profits of 11.75 for the incumbent and 2.75 for the entrant. Thus it is better for the entrant than the one of part (b). However, it involves an incredible threat on the part of the entrant. For example, if the incumbent were to choose $x = 6.5$, it would the entrant's interest to choose $y = 2.75$ rather than $y = 3$.

(f) In the backward-induction solution the incumbent chooses $x = 7$ and $p = 6$. If she were a protected monopolist then she would have the following profit function: $\pi(x) = x\,(13 - x) - x - 6.25$. Solving $\pi'(x) = 0$ we get $x = 6$ and thus $p = 7$. Thus if there were no threat of entry, she would produce less and charge a higher price.