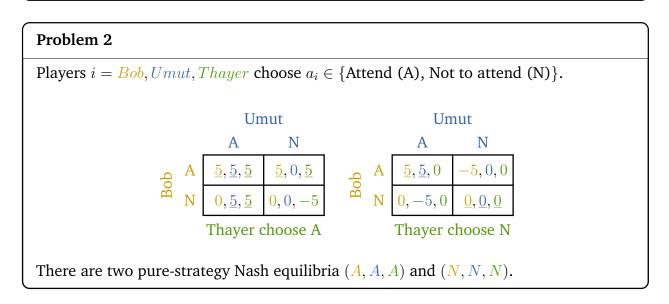
There are two pure-strategy Nash equilibria (*Stag*, *Stag*) and (*Hare*, *Hare*).



Problem 3

Players i = Jerry, Duece choose $a_i \in [0, \infty)$. Note that a_i is an integer.

(i) Scenario 1: Suppose both *Jerry* and *Duece* gets the prize when $a_{Jerry} = a_{Duece}$.

• Player i's best response to Player j's actions:

$$BR_i(a_j) = \begin{cases} \{a_j, a_j + 1, a_j + 2, \dots\} & , if \quad 0 \le a_j < 20\\ \{0, 20, 21, \dots\} & , if \quad a_j = 20\\ \{0\} & , if \quad a_j > 20 \end{cases}$$

The set of Nash equilibria is the intersection of the best response functions, which are

EC 468

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$$(0, 0)$$
, $(1, 1)$... $(20, 20)$, where $a_{Jerry} = a_{Duece}$ and $a_i \in [0, 20]$

- $(20,0), (0,20), (0,21), (21,0), (0,22), (22,0) \dots$, where $a_i \in [20,\infty)$ and $a_j = 0$

(ii) Scenario 2: Suppose neither of *Jerry* and *Duece* gets the prize when $a_{Jerry} = a_{Duece}$.

• Player i's best response to Player j's actions:

$$BR_i(a_j) = \begin{cases} \{a_j + 1, a_j + 2, a_j + 3 \dots\} & , if \quad 0 \le a_j < 20 \\ \{0, 21, 22 \dots\} & , if \quad a_j = 20 \\ \{0\} & , if \quad a_j > 20 \end{cases}$$

Nash equilibria are (20, 0), (0, 20), (0, 21), (21, 0), ..., where $a_i \in [20, \infty)$ and $a_j = 0$

Problem 4

Players i = 1, 2 choose $x_i \in [0, 10]$. Note that x_i is an integer.

• Player i's best response to the other Player j's actions:

$$BR_i(x_j) = \begin{cases} \{10 - x_j, \dots, 10\} &, if \quad 0 \le x_j < 6\\ \{5,6\} &, if \quad x_j = 6\\ x_j - 1 &, if \quad 6 < x_j \le 10 \end{cases}$$

Nash equilibria are (5, 6), (6, 5), (5, 5) and (6, 6).

Problem 5

(i) Suppose the person only cares about her own comfort.

| | Player 2 | |
|-------------|-------------|--------------------|
| | Sit | Stand |
| J Sit | 1, 1 | $\frac{2}{2}, 0$ |
| Playe Stand | <u>0, 2</u> | <mark>0</mark> , 0 |

There is only one pure-strategy Nash equilibria (Sit, Sit).

(ii) Suppose the person is altruistic.

| | Player 2 | |
|------------|--------------------|--------------------|
| | Sit | Stand |
| Sit | 2, 2 | $0, \underline{3}$ |
| Land Stand | $\underline{3}, 0$ | 1, 1 |

There is only one pure-strategy Nash equilibria (*Stand*, *Stand*).

Problem 6

Both players would try to maximize their payoff.

• Player 1's best response:

$$x^{*}(y) = \operatorname*{argmax}_{x}(3+6y-\frac{3x}{2})x$$

F.O.C:
$$3 + 6y - 3x = 0 \implies x^*(y) = 1 + 2y$$

• Player 2's best response:

 $y^*(x) = \underset{y}{\operatorname{argmax}} (6 - x - \frac{y}{2})y$ F.O.C: $6 - x - y = 0 \implies y^*(x) = 6 - x$

Combine $x^*(y)$ and $y^*(x)$, we get $x^* = \frac{13}{3}$ and $y^* = \frac{5}{3}$. The Nash equilibria is $\left(\frac{13}{3}, \frac{5}{3}\right)$