Advanced Machine Learning **Exercise sheet 4**
SoSe 2023

Solution 1:

a)

$$\text{payoff}(\{\texttt{t},\texttt{m}\}) = 10 + 10 + 20 = 40$$

$$\text{payoff}(\{\texttt{t},\texttt{j},\texttt{s}\}) = 10 + 10 + 2 - 30 = -8$$

b) Pseudocode of `payoff_func()`

Algorithm 1 `payoff_func()`

```
Require: coalition: Coalition vector
t ← boolean if 't' is in coalition
s ← boolean if 's' is in coalition
m ← boolean if 'm' is in coalition
j ← boolean if 'j' is in coalition
l ← boolean if 'l' is in coalition
return 10 * t + 10 * m + 2 * j + 20 * (t and m) + 20 * (t and m and s) - 30 * ((t or m or s) and j)
```

Pseudocode of `all_unique_subsets()`

Algorithm 2 `all_unique_subsets()`

```
Require: population: vector containing all available players
if population = ∅ then subsets ← ∅
else if population ≠ ∅ then subsets ← all subsets of population
end if
return subsets
```

Pseudocode of `shapley()`

Algorithm 3 `shapley()`

```
Require: population: vector containing all available players
Require: member: vector containing the player(s) of interest
Require: vfunc: value function
remainder ← everyone from the population but member
all_sets ← all_unique_subsets(remainder)
F ← length of population
for s in all_sets do
    S ← length s
    diff ← vfunc(s + member) - vfunc(s)
    factor ← S! * (F - S - 1)! / F!
    val ← val + factor * diff
end for
return val
```

Solution 2:

Solution 3: