

# Introduction to electronic voting

## Assignment nr 2 (22-26 X 2012)

1. Assume that you have a receipt generated by the ThreeBallot scheme with  $k$  marked rows and  $n$  candidates. Find the number of Ballot pairs that form a valid tripple with your receipt. Compute how many different receipts are possible in that scheme.
2. Consider a modification of the VAV scheme, where one can vote for up to  $k$  out of  $n$  candidates. On the figure below there is an example of a valid vote for Dog.

<i>Vote</i> ■■■■	<i>Anti – vote</i> ■■■■	<i>Vote</i> ■■■■
1. Dog <input checked="" type="checkbox"/>	1. Dog <input type="checkbox"/>	1. Dog <input type="checkbox"/>
2. Cat <input type="checkbox"/>	2. Cat <input checked="" type="checkbox"/>	2. Cat <input checked="" type="checkbox"/>
3. Fish <input checked="" type="checkbox"/>	3. Fish <input checked="" type="checkbox"/>	3. Fish <input type="checkbox"/>
4. Parrot <input type="checkbox"/>	4. Parrot <input type="checkbox"/>	4. Parrot <input checked="" type="checkbox"/>

Find a number of correct receipts.

3. Assume that Election Authority knows serial numbers of all ballot tripples that were cast and tries to modify election outcome. If they modify one of your ballot-parts, what is the probability that you do not detect that while checking a receipt on a bulletin board? Assume that  $k$  voters whose ballots were modified are checking their receipts online. What is the probability of undetected malfeasance?
4. Assume that  $N$  votes were cast ( $3N$  ballots) and Election Authority modified  $k$  ballots (each one from a different tripple), what is the probability that the malfeasance is detected when a random sample of  $m$  voters verified their receipts online? Compute that probability for different parameters  $N = 10, 100, 1000, 10\ 000$ ,  $k = cN, c = 0.01, 0.1$  and  $m = pN, p = 0.01, 0.05, 0.1, 0.2$ .
5. Election Authority may modify election outcome by changing only those ballots that were cast by themselves – then, there are no voters who can complain about a receipt. Analyze what can be achieved with that approach in three candidate race. Consider both VAV and ThreeBallot schemes. Can this situation be detected by just observing bulletin board? Give necessary and sufficient conditions for detection (if there are any).