

## 2nd set of exercises 3.2.2011

1. Let  $X_i$ ,  $i = 1, \dots, n$  be independent Bernoulli distributed random variates. Thus  $X_i$  takes value 1 with probability  $p$  and value 0 with probability  $(1 - p)$ .

a) Calculate the expected value and variance of  $X_i$ .

b) Calculate the expected value and variance of  $\hat{p} = \sum_{i=1}^n X_i/n$ .

c) Carefully explain why  $\hat{p}$  (approximately) follows the Normal distribution when  $n$  is large, and what is the mean and variance of this Normal distribution.

2. Finnish students of Tilastotieteen jatkokurssi (the Second course in statistics in Finnish) were asked (2nd intermediate exam of 4.5.2010) whether two exercise groups should be converted into workshops where exercises were solved in teams and the conductor of the workshop could be asked for advice. 18 students voted for the conversion and 5 were against. Thus 78,3 % of the students supported the idea and 21,7 % were against it. Calculate a 95 % confidence interval for the proportion of students supporting the conversion. Does the confidence interval include the proportion 50 % or smaller proportions?

3. Yle news reported on the 28th of January 2011:<sup>1</sup>

*A fresh opinion poll commissioned by YLE shows another increase in support for the True Finns party. Support for the party now stands at a record 16.6 percent. The popularity of the True Finns has been growing rapidly since last February. In just one year, support for the party has increased by ten percentage points. Up to now, the True Finns Party Chair Timo Soini has responded to his party's growing support with cautious optimism. With the release of the new figures, Soini evidenced a confident tone, as he revealed his ambitions to become the next Government's Minister of Economic Affairs. The True Finns Chair was also scathing about Finland's current climate and energy policies, in addition to saying that he would not sit in government with the Green Party. - Nearly 2900 people were interviewed for the poll in January. The margin of error is plus minus 1.7 percentage points.*

Yle gives more detailed information about the poll in its web pages in Finnish:<sup>2</sup> The target group of the Gallup poll was Finnish citizens excluding those living in Åland in the age range 18–79. Altogether 2892 people were interviewed of whom 2005 (69,3 %) revealed their political preference. The interviews were made 3.–27.1.2011. Taloustutkimus oy carried out the poll.

<sup>1</sup>[http://yle.fi/uutiset/news/2011/01/true\\_finns\\_on\\_the\\_rise\\_2324370.html](http://yle.fi/uutiset/news/2011/01/true_finns_on_the_rise_2324370.html) (referred to on the 29th of January, 2011).

<sup>2</sup>[Http://www.yle.fi/tvuutiset/uutiset/upics/liitetiedostot/YLE\\_Puoluekannatus\\_tammikuu\\_2011.pdf](http://www.yle.fi/tvuutiset/uutiset/upics/liitetiedostot/YLE_Puoluekannatus_tammikuu_2011.pdf); referred to on the 29th of January, 2011,

Taloustutkimus oy tunes — by a technique not explained here — the obtained poll figures. Let us ignore the tuning and assume that the reported figures are the obtained poll figures in a randomly drawn sample of Finns.

a) What is the the 95 % confidence interval for the supporting figure of the True Finns party? Compare it to the margin of error figure referred to in the above piece of news.

b) How large a sample would be needed for the confidence interval to be of length 0,5?

c) What is the the lower bound for the 95 % confidence interval for the supporting figure of the True Finns party?

4. Internet based newspaper Uusi Suomi reported on the 29th of October, 2010<sup>3</sup>:

*40 percent would unify the Nordic countries. A federation of the Nordic countries gains surprisingly much support from the citizens of the Nordic countries. According to a study published by the Nordic Council 42 percent of the citizens of the Nordic countries take a very positive or a positive attitude to the idea that the Nordic countries would compose a federation with a common constitution and head of state. On the other hand, 40 percent of the citizens take a negative attitude and 18 percent a very negative attitude to an actual political federation. The study relates to the publication of the book "The Nordic Federation" by the historian Gunnar Wetterberg. He suggested last year that the Kalmar Union<sup>4</sup> should be reestablished with Queen Margrethe II of Denmark as the head of the state. Over 1000 people were interviewed in the Nordic countries of whom 201 were Finns.*

a) Calculate the 99 % upper bound for the confidence interval for the proportion of people in the Nordic countries who are supportive of the federation. Does it include the proportion 50 percent?

b) Let us assume that the interviewed Finns happened to have exactly the same opinions about the federation as the citizens of the Nordic countries as a whole. Calculate the 99 % upper bound for the confidence interval for the proportion of people in Finland who are supportive of the federation. Does it include the proportion 50 percent?

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<sup>3</sup>[Http://www.uusisuomi.fi/kotimaa/104901-40-yhdistaisi-pohjoismaat](http://www.uusisuomi.fi/kotimaa/104901-40-yhdistaisi-pohjoismaat) (referred to on the 29th of October, 2010). Translated by the lecturer.

<sup>4</sup>A federation of the Nordic countries 1397–1523.