# Quantitative Methods Exam

2010 February, 19$\underline{^{\text{th}}}$

1. A certain company wishes to estimate the average amount of money $\mu_y$ paid to the workers for their formation. As auxiliary information the company has also average quarterly reports about the fiscal situation of the previous year. A random sample of 100 workers is taken from the population of 1000 workers. The sample data are

| $\sum_{i=1}^{100} y_i = 1750$ | $\sum_{i=1}^{100} x_i = 1200$ | $\sum_{i=1}^{100} y_i^2 = 31650$ |
|---|---|---|
| $\sum_{i=1}^{100} x_i^2 = 15620$ | $\sum_{i=1}^{100} y_i x_i = 22059.35$ | $\tau_x = 12500$ |

where $\tau_x$ is the total of the population corresponding to the quarters of the previous year.

Use the previous data to estimate $\mu_x$ and to place a bound on the error of estimation.

2. A firm studies the television advertising in a certain county and takes a sample survey to estimate the average number of hours per week that households, within the county, watch TV. The county contains two towns ($A$ and $B$) and a rural area. Town A is built around a factory, and most households contain factory workers with school-aged children. Town B is a exclusive residential city and contains older residents with few children at home. There are 155 households in town $A$, 62 in Town $B$ and 93 in the rural area. The firm thinks that the stratum variances are approximately equal with a value roughly equal to 10. The firm desires to estimate the average number of hours per week that households in the county watch television, with a bound on the error of estimation equal to 2 hours. Telephone interviews are used. Justify which kind of costs must be considered in this case. Find the sample size and stratum sample sizes necessary to achieve this accuracy.

3. (a) Explain the main aspects of the *k-means* algorithm.

   (b) Expose briefly the weaknesses and strengths of *Tree Models* methods.