Probability and Statistics
Final test (90 minuts, 0-67 points)

1. The article describes a cancer testing scenario:
   - 1% of women have breast cancer (and therefore 99% do not).
   - 80% of mammograms detect breast cancer when it is there (and therefore 20% miss it).
   - 9.6% of mammograms detect breast cancer when it's **not** there (and therefore 90.4% correctly return a negative result).

   Now suppose your friend get a positive test result. What is the chances she has cancer?

   7p

2. Joint probability distribution of a random vector $(X; Y)$ is given as:

X\Y	-1	0	2
-2	0,2	0,2	0,3
3	0	0,3	0

   Find:
   a) marginal probability functions $P_X(x)$ and $P_Y(y)$,
   b) expected values $E(X)$ and $E(Y)$,
   c) standard deviations $\sigma(X)$ and $\sigma(Y)$,
   d) correlation coefficient $\rho(X; Y)$.

   2p+2p+4p+4p

3. During a particular period a university's information technology office received 20 service orders for problems with printers, of which 8 were laser printers and 12 were inkjet models. A sample of 5 of these service orders is to be selected for inclusion in a customer satisfaction survey. Suppose that the 5 are selected in a completely random fashion, so that any particular subset of size 5 has the same chance of being selected as does any other subset. What then is the probability that exactly 4 of the selected service orders were for inkjet printers?

   12p

4. If 10% of California residents are vegetarians, test the hypothesis that people who gamble are less likely to be vegetarians. If the 120 people polled, 10 claimed to be a vegetarian. + Calculate 95% confiidence interval for proportion of vegetarians in California.

   6p+6p

5. A random sample of 500 persons is questioned regarding their political affiliation and opinion on a tax reform bill. Test if the political affiliation and their opinion on a tax reform bill are dependent at 5% level of significance. The observed contingency table is given below:

	favor	indifferent	opposed	total
democrat	138	83	64	285
republican	64	67	84	215
total	202	150	148	500

   Using alpha = 0,05, would you conclude that political affiliation and their opinion on a tax reform bill are independent?

   12p

5. A manager wishes to determine whether the mean times required to complete a certain task differ for the three levels of employee training. He randomly selected 10 employees with each of the three levels of training (Beginner, Intermediate and Advanced). Do the data (task_time.xls, http://k470.vsb.cz/litschmannova/teaching/statistics/data/) provide sufficient evidence to indicate that the mean times required to complete a certain task differ for at least two of the three levels of training? Use significance level 0,10.

12p