a) You want to specify the response time of a Web service that you have developed for the Lisbon Stock Exchange, showing the average response time in milliseconds as well as the confidence interval. The Web service receives as input parameters the identifier of a company (VAT) and a date, and provides as output the total amount in euros for the buying and selling transactions of the papers of the company in the specified date. You have performed a set of experiments with a representative load (set of invocations of the service using companies from the PSI20 and a variety of dates) and measured the response time of the Web service. The Web service was used inside the same network where the servers of the Lisbon Stock Exchange are connected to, in order to avoid the unpredictable delays of remote networks. The results obtained are the following (in milliseconds):

Average response time: 45.28
Number of tests of the web service: 180
Standard deviation: 8.23

Calculate the confidence interval with a confidence level of 95% and indicate the response time of the Web service in a technically correct and complete way. (assume that the samples are independent and normality distributed)

b) Suppose you are the data center administrator of a big organization and you are about to decided if your organization should accept the new cooling system that was recently installed in the data center or not. As the cooling system is very expensive, the contract defines precisely the conditions that should be met, concerning the temperature inside the server racks. Quoting the contract: “The cooling system must assure that the temperature inside the racks is always within 16 Celsius ± 0.8 degrees, as a safe interval . In order to be sure that the cooling system is operating within the values defined in the contract, you decided to measure the temperature in the racks using a high precision electronic thermometer. To assure representative measurements, you took many measurements (more than 100), including a variety of server loading scenarios and covering the 24 hours of the day. The results obtained show an average temperature of 16.245 Celsius with a standard deviation of

2.234. Do you think the conditions defined by the contract are met and your organization should accept the cooling system as is?

c) Consider the scenario described in the previous question but now suppose that you could only take 15 measurements (and assume that the mean and standard deviation is the same). Explain what is different in this case. Consider both the arguments of the data center administrator (your perspective) and the vending representative of the cooling system.

d) Consider that you want to compare the performance of two algorithms (A and B) in your laptop. You ran Algorithm A on 1623 randomly generated inputs and recorded a mean of 128.2 seconds and standard deviation 17.5. Then, you ran Algorithm B on 1911 randomly generated inputs and recorded a mean of 126.5 and standard deviation 20.1. What conclusion can you take from the confidence interval for the difference between means? Assume 95% confidence level.

e) Now you want to compare the performance of Algorithm A and B in the same set of inputs. You recorded the following values of CPU-time in seconds:

#input	Algorithm A	Algorithm B
1	168	141
2	111	119
3	139	122
4	127	127
5	155	125
6	115	123
7	125	113
8	123	106
9	130	131
10	137	142
11	130	131
12	129	135
13	112	119
14	141	130
15	122	121

What conclusion can you take from the confidence interval at 95% confidence level?

f) You have developed a new spam filter and you would like to know how effective it is. You have randomly chosen a set of 1792 e-mails from your mailbox and ran your spam filter. Your software reported 244 cases

incorrectly. Now, you would like to report the proportion of false positives with some 95% confidence.