Coursework 3. Submission deadline 20/01/20

1 RSA encoding

For this exercise, I recommend that you either use a claclulator or even write a short program in Python helping you to choose the required numbers, This progam though is not part of the answer, so please feel free to ignore my advice.

Please answer the followjng questions regarding the RSA encoding.

1. **15 marks.** Let $p = 13, q = 11$. Choose an arbitrary e *as allowed by the RSA algorithm* and compute the number d for this e. Explain how you obtained the number d.

2. **15 marks.** Using the numbers e and d that you picked in the previous question encrypt number 120.

2 Conditional probabilities

Remark. In your answers to all three questions of this section, give an explanation as to why you believe your answer is correct. Marks will not be awarded for answers with numbers not accompanied by any explanation or accompanied by meaningless or irrelevant statements.

Consider a department of Computer Science with which 500 students are currently registered. 280 of these students are female and 220 are male. The department offers two undergraduate degrees: Computer Science and Computing with Management. Each student at the department is registered with *exactly one* of these degrees. In particular, 300 students study Computer Science and 200 students study Computing with Management. Exactly half of the students studying Computer Science are female.

Given the above data, please answer the following questions.

1. **10 marks.** How many female and how many male students study Computing with Management?

2. **10 marks.** What is the probability that a student studies Computer Science *provided that* this student is male?

3. **10 marks.** Infer the probability asked in the previous item using the Bayes formula.

Hint: For this you need first to compute the probability that a student is male, the probability that a student studies Computer Science, and the probability that the student is male provided that he studies Computer Science.

3 Quality of spam filtering

Remark1. Although this question is related to probabilities, you do not need to use any probability theory whatsoever. That said, the exercise requires some command with percents and a good deal of common sense reasoning.

Remark 2. In your answers to both questions of this section, give an explanation as to why you believe your answer is correct. Marks will not be awarded for answers with numbers not accompanied by any explanation or accompanied by meaningless or irrelevant statements.

Imagine that an email server runs a spam filter flagging some of the incoming messages as spam. The following facts are known.

1. Only 1% of the incoming emails are spam.
2. The spam filter flags 2% of the incoming messages as spam.

With this information at hand, please answer the following questions.

1. **10 marks.** What is the *lowest* possible percent of genuine messages marked as spam by the spam filter?
2. **10 marks.** What is the *highest* possible percent of genuine messages marked as spam by the spam filter?
3. **10 marks.** What is the *lowest* possible percent of genuine messages *among* those that are flagged as spam?
4. **10 marks.** What is the *highest* possible percent of genuine messages *among* those that are flagged as spam?