Department of Mathematics and Statistics

MM913/MM507 Risk Analysis Project

One thousand 100g portions of cooked chicken breast were tested for contamination with *Campylobacter*, a form of food poisoning. Of the 1,000 portions tested, 20 were found to be contaminated and the Log_{10} counts for the number of *Campylobacter* per 100g portion are given in the attached data-sheet. The minimum and maximum Log_{10} counts are 0.1 and 3.0 respectively.

A recent food consumption survey has indicated that the average person in Great Britain (GB) eats 2 100g portions of cooked chicken breast each week.

Assuming that the risk of illness, given an ingested *number* of *Campylobacter* can be predicted from the model

$$R = 1 - e^{-\alpha D}$$

where D is the ingested *number* of organisms and $\alpha = 0.00005$ is the susceptibility parameter, use Monte-Carlo simulation to address the following.

1. Derive the probability distribution for the risk (R) of a random person in GB becoming ill from eating a 100g portion of cooked chicken breast (6 marks).
2. Using the mean of the probability distribution derived in (1) above, estimate the *annual* risk of illness for the average person in GB (3 marks).
3. Investigate the effect of changing the dose of ingested organisms (2 marks).
4. Investigate the effect of changing the prevalence (proportion) of contaminated cooked chicken breasts (2 marks).
5. Investigate the effect of changing the susceptibility parameter (2 marks).
6. Write a report outlining your model and results (15 marks).

Notes

1. This project is marked out of 30 and counts for 30% of the overall mark for MM913/MM507.
2. Your group report should be submitted to Myplace **no later than 5pm on Thursday 2 April**. Late submissions will be subject to deductions in accordance to the University's policy, namely: coursework that is submitted late, but within 24 hours of the submission deadline, or approved extended submission deadline, will be subject to a 10 point deduction on the percentage mark being applied to the original mark. For each subsequent day, or part day, that a coursework is submitted late up until seven calendar days from the deadline, a penalty of 5 percentage point deduction per day or part day will be applied to the original mark.
3. You should write up the results as a scientific report which should be no more then 4 pages of A4 with minimum 11pt font. Your report should contain the following sections

- Introduction: Here you should briefly discuss the problem of *Campylobacter*, using any source of information available to you. You should include the aim of your report.
- Methods: Here you should describe your model, any assumptions you have made and the data used to derive your estimates of risk. You should describe the sensitivity analysis you will perform.
- Results: In this section, you should provide a clear summary of your results highlighting the main findings and, including summary statistics plots and relevant tables.
- Discussion: Here you should discuss the implications of your findings and include, for example, thoughts on ways to reduce risk, validity of assumptions and possible extensions to the model.

4. You should also include your R code in an appendix.

5. You can include any relevant references at the end of a document. References are not included in the 4 page limit.

Note: These data are not real!!