M1S TUTORIAL SHEET : WEEK 3

1. The three basic interpretations of probability presented are as follows; for an event E in sample space Ω representing the possible outcomes of experiment

RELATIVE FREQUENCY	$\mathrm{P}(E)$ is the relative frequency with which E occurs in an infinite sequence of repeats of the experiment under identical conditions.
CLASSICAL	when Ω comprises sample outcomes that are, equally likely, then $\mathrm{P}(E)$ is the proportion of the sample outcomes that are contained in E.
SUBJECTIVE	in a hypothetical gamble, in which an amount M is won if E occurs, and amount zero is won if E does not occur, $\mathrm{P}(E)$ is the stake, as a proportion of M, that is a regarded as a fair price to pay to enter into the gamble (by both the "gambler" and "bookmaker").

For each of these interpretations, verify that that the three probability axioms are justified and meaningful; for example, in each case think of a *particular* E and Ω, then try to generalize.

2. For each of the following experiments, state the sample space Ω, and for the given event E, consider how $\mathrm{P}(E)$ can be evaluated.

(i) A person is chosen at random from the general population, and their birthday determined. E is the event "birthday is in January".

(ii) A person is chosen at random from the general population, and their date of birth determined. E is the event "year of birth is before 1970".

(iii) 1000 fair dice are thrown. E is the event "sum of scores is greater than 3000".

(iv) The length of time for which a light-bulb, produced in a mass manufacturing process, functions is measured. E is the event "functions at least for time x" (for real value x).

(v) The noon temperature at a given location is to be measured. E is the event "temperature is less than x Celsius" (for real value x).

NOTE: *in this course, we will largely be viewing the probability function,* $\mathrm{P}(.)$, *as a mathematical entity and studying its properties, so the distinctions between the different interpretations are not crucial.*