The Actuarial Profession
making financial sense of the future

Project L6

Instructions to CA2 candidate

(i) Read the attached document, which describes the background to this project. You will also be given an additional piece of information later on in the day.

(ii) Copy the data provided into a new spreadsheet. Check the data and make any adjustments you feel necessary.

(iii) Build a model that uses the data to calculate the "probability of success" based on the "first place" approach and then convert these probabilities to odds in line with the bookmaker's requirements.

(iv) Repeat (iii) but with "probability of success" based on the "fastest" approach using the proposed scoring system.

(v) Illustrate the probabilities under both approaches in a suitable chart(s).

(vi) Using the probabilities determined in (iv), calculate "1-2" odds in line with the bookmaker's requirements.

(vii) Repeat the above as necessary using the additional information given to you later in the day.

(viii) Prepare a set of five or six summary pages using bullet points and visual aids capturing the main features and results. You should cover the following:

- Data, approach and assumptions used
- Probabilities and winning odds under both approaches
- "1-2" odds
- Results using new information
- Conclusions, including next steps

Hints:

You can assume that all odds can be stated in the form "X to 1".
If someone places a "to win" bet of £1 (their stake) on Dog Z at odds of X to 1, then if Dog Z does not win they will receive nothing. If Dog Z does win then they will receive back their original stake plus X times their original stake, i.e. £(X+1) in this example.
If an event has a probability of ¼ (e.g. that a card drawn at random from a deck of cards is a spade) then the odds of this event occurring are "3 to 1". In other words, in four attempts it would be expected that the event would fail 3 times and be successful once.
Similarly, if an event has a probability of 0.125 (1/8) then the odds of the event occurring are "7 to 1".

If A and B denote events, then the joint probability of A and B (i.e. the probability of both events occurring) can be calculated as P(A,B) = P(A¦B) * P(B), where P(A¦B) denotes the probability of event A given that event B has occurred. Hence, the probability that X & Y are the two fastest dogs (in either order) is given by P(X is fastest) * P(Y is fastest after X) + P(Y is fastest) * P(X is fastest after Y)
where P(Y is fastest after X) = P(Y is fastest)/(1- P(X is fastest))

Background for CA2 candidate – Project L6

The owner of a racing kennels has six greyhounds, which have been given numbers and racing names as follows:

1	Gaussian Girl
2	Lagrangian Lad
3	Bernoulli Boy
4	Longevity Legs
5	Statistically Superior
6	Demographic Devil

As part of their training, he regularly races them against each other and keeps informal records of their performance. A local bookmaker has learned of these races and has decided to look into whether there is any potential for making some money, perhaps from encouraging the kennel staff to bet on the outcome.

The kennel owner is happy with this suggestion and has provided the bookmaker with details of the order in which the dogs have finished in each of the last 30 training races. The data shows the most recent race first (i.e. the first row).

The bookmaker has first decided to calculate odds “to win” for each dog. This will be done by first by calculating the “probability of success” for each dog.

The bookmaker is first interested in calculating odds by basing the “probability of success” measure on the number of wins for each dog. He refers to this as the “first place” approach.

However he is a little nervous about the fact that he only has data on 30 races. He has therefore suggested an alternative system that also takes into account the relative performance of the dogs in the other positions. He has suggested that a scoring system should be used. This allocates 10 points to the first placed dog, 5 to the second, 3 to the third, 2 to the fourth and 1 to the fifth, with no points for last place. He would then like to use the way in which these points are distributed between the dogs to determine the “probability of success” and hence to set his betting odds. He refers to this as the “fastest” approach.

Finally, he would also like to calculate “1-2” odds for each possible combination of two dogs. These would be based on the probability that dog X and dog Y are the first two dogs to finish, in either order. As there is limited data, he would like to do this using the probability information already derived from using the “fastest” (scoring system) approach.

The bookmaker has asked for your help in analysing the data in order to perform these calculations. He has informed you that he would expect to make a profit of 5% on all bets placed and this should be factored into the calculated odds.

A further piece of information will be provided later on in the day.

Additional information for CA2 candidate – Project L6

To be provided later on in the day

The bookmaker has just had a tip-off from one of the kennel girls that there may have been some dodgy dealings with Demographic Devil.

The girl claims that one of the kennel boys had been slipping performance powder into Demographic Devil's food. She says that she warned the boy that she would report him and he then stopped. She believes that this would have impacted the greyhound's performance in each of the first 12 recorded races, i.e. up to the point at which she gave the warning. She has estimated that the performance powder would have given Demographic Devil an unfair advantage of around two positions.

The bookmaker is obviously concerned about these allegations and their impact on his profit margin. He would therefore like you to recalculate the winning odds using the "fastest" approach, assuming that the information provided by the kennel girl is correct.