

# An odds calculation on the champion's league 2008

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## 1 Introduction

The following is a calculation regarding the quarter final draw in the champion's league (football) 2008. For this year there were four English teams in the competition at the quarter final stage. A colleague offered odds of 13/1 against the draw consisting of no English team playing each other. Is this correct?

## 2 First calculation

Writing  $E_i$  as an English team and  $C_i$  as a Continental team,  $i = 1, \dots, 4$ . We wish to form combinations of the form

$E_1$	$C_1$
$E_2$	$C_2$
$E_3$	$C_3$
$E_4$	$C_4$

There are  $8!$  permutations of placing each of the 8 teams in each of the positions in the above table. However, to calculate the required probability we need to take into account that we can interchange any Continental team with any other (b) interchange any English team with any other or (c) interchange the home or away draw and still lead to a favourable draw. Hence the required probability is

$$\frac{(4!) \times (4!) \times (2^4)}{8!} = \frac{8}{35} \quad (1)$$

## 3 Second calculation

We wish to calculate the the probability of no English team playing each other directly. We select the first team in the first draw. Whatever the type, English or Continental, we next wish to select the opposite type, the probability of this is  $4/7$ . The next selection from the draw is irrelevant, however following that we need the opposite type, the probability of which is  $3/5$ . We need to follow the

same logic one further iteration; to make the probability of the next selection favourable requires a selection of probability of  $2/3$ . If these three draws are favourable the last is perfectly determined, so the probability of making the first three selections is

$$\frac{4}{7} \times \frac{3}{5} \times \frac{2}{3} = \frac{8}{35} \quad (2)$$

## 4 Conclusion

Lift the odds of 13/1!!