

# 國立中山大學應用數學系

## 學術演講

講者：林奕伸 博士

中央研究院統計科學研究所

講題：The Mabinogion sheep problem

時間：2017/04/20 (Thursday) 14:10 ~ 15:00 pm

地點：理學院四樓理 SC 4009-1 室

茶會：15:00 於理 SC 4010 室 (系辦公室)

### Abstract

In this talk, we will introduce an optimal control problem for the Mabinogion sheep model, which was first considered by D. Williams. There is a magical flock of sheep, some black and some white. At each stage  $t = 1, 2, \dots$ , a randomly chosen sheep bleats; if the bleating sheep is white, one black sheep instantly becomes white; if the bleating sheep is black, one white sheep instantly becomes black. Suppose that this system can be controlled by removing any number of white sheep at (the end of) each stage. The goal is to find a control strategy to maximize the expected final number of black sheep. By applying the martingale optimality principle, D. Williams shows that the problem is solvable and admits a simple solution. We propose a more general model  $M(p, q)$ , in which at each stage, when the bleating sheep is white (black, *resp.*), a black (white, *resp.*) sheep (if any remain) instantly becomes white (black, *resp.*) with probability  $p$  ( $q$ , *resp.*) and nothing changes with probability  $1 - p$  ( $1 - q$ , *resp.*). Note that the original model corresponds to  $(p, q) = (1, 1)$  and that  $M(p, q)$  is equivalent to  $M(p', q')$  if  $p/q = p'/q'$ . Following Williams' approach, we show that model  $M(p, q)$  admits a simple solution if  $p/q = 1/2$  or  $2$ . We also present some numerical results for model  $M(p, q)$  with  $p/q \notin \{1/2, 1, 2\}$ , indicating that an intuitively appealing strategy is not optimal for the general model.

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