



UNIVERSITY OF EXETER

COLLEGE OF ENGINEERING, MATHEMATICS AND PHYSICAL SCIENCES

ECM3735 - GROUP 8

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# Finding the optimal strategy for the dice game 'Pig'

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November 22, 2017

## **Abstract**

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# 1 Introduction

Suppose I have 2 strategies A and B. Consider that it is A's turn and we are in position  $(i, j, k)$  where  $i$  is A's banked points,  $j$  is B's banked points, and  $k$  is A's points so far on this turn. Let  $P_{ijk}$  denote probability of A winning from that position and  $Q_{ijk}$  denote probability of B winning from the equivalent position (where  $i$  then represents B's banked points ect). Then,

$$p_{ijk} = \frac{1}{6}(1 - Q_{ij0}) + \frac{1}{6} \sum_{r=2}^6 P_{ijk+r} \quad (1)$$

if A rolls and

$$p_{ijk} = 1 - Q_{jik} \quad (2)$$

if A holds.

## 1.1 Aims and Objectives

josh

## 1.2 History of Pig

Liam

### 1.2.1 Basics of Pig

### 1.2.2 Nellers Work

## 1.3 Optimal Strategy

chris C

## 1.4 Preliminary Findings

chris N

# 2 Methodology

## 2.1 Group Organisation

Mia

### 2.1.1 Meetings

### 2.1.2 Creation of Project Plan

## 2.2 Piglet

Chris C

### 2.2.1 Hand Written notes

### 2.2.2 Coding Pig

### 2.2.3 Piglet Findings

## 2.3 Pig

anthony and rhodri

### 2.3.1 Expansion from Piglet

I DID SOMETHING IOMPORTANT HERE

### **2.3.2 Debugging of the code**

## **2.4 Behavioural Economics**

Mia and Josh

## **2.5 Statistical Testing**

eliot and sam

### **2.5.1 Fair test**

### **2.5.2 Theory of Hypothosis testing**

### **2.5.3 Running of tests**

## **3 Findings**

### **3.1 Pig**

#### **3.1.1 Did we solve Pig**

YES.

### **3.2 Behavioural Economics**

#### **3.2.1 Do players stick to their risk preference**

#### **3.2.2 Players Interactions**

### **3.3 Statistical Testing**

#### **3.3.1 Non-transitivity**

#### **3.3.2 Testing against our optimal**

#### **3.3.3 Testing against Nellers optimal**

## **4 Conclusions**

### **4.1 Overall findings**

### **4.2 Determination of human affects on the optimal strategy**

### **4.3 Comparison to Nellers strategy**

## **References**