# CS 405 An Introduction to Empirical Modelling

## Module Assignment

You have been approached by RU-BOARD?, a manufacturer whose profits have been eroded by the emergence of computer games, and which hopes to revive interest in old-fashioned board games by investing in computer support for their design and manufacture. They have commissioned you as a consultant to advise on the suitability of adopting Empirical Modelling (EM) principles and tools as one of the technologies to use for this purpose. They have asked for the following material to be presented to the Board in time for their meeting on **Friday 17th January 2003** (at noon).

(i) Your first task is to develop a model using EM of the ancient game of Pjawns (see overleaf) as a case-study and illustration of how the EM approach might be useful. With the general aim of effective prototyping, development and evaluation of games in mind, your model should address such issues as conducting experiments with the rules, implementing a computer player and some playing strategies, recording games and storing positions. You should show awareness of previous game models in EM.

(ii) Write a short report based on your experience on the nature of the model-building activity in EM. Given the tools in their current stage of development, what do you recommend as the best way of organizing the model-building activity and how might the supporting tools be used and developed to facilitate good organization?

(iii) Finally include a brief evaluation of the possible advantages and disadvantages of using EM methods for design and development at RU-BOARD?. You should include advice about whether it is appropriate to use EM in conjunction with other software development methods and programming paradigms.

To help allocate your time on this consultation the Board have indicated that they would estimate the value of these tasks in ratio 5:3:2 and that they prefer reports, as in (ii) and (iii), to each be no longer than 1500 words.

## About the assignment

*The assignment carries 50% of the total credit for the module. You will be expected to provide an overall description of your model, and a brief guide to its use, in the format that has been adopted in the EM archive at http://empublic.dcs.warwick.ac.uk/ and to submit the accompanying files via the BOSS electronic submission system. Further guidance about relevant background resources, and guidelines concerning the nature of the submission expected will be given as appropriate, primarily through the laboratory sessions to be held in the Computer Systems Laboratory at 2pm on Mondays, but also in the lectures in weeks 6-10.*

# The Game of Pjawns[*]

Pjawns is played on a chess board. There are two players, **White** and **Black**, each of whom has 8 pjawns that are coloured white and black respectively. The board is initially empty. Players move alternately, either placing a pjawn on the board, or making a valid pjawn move. The W and B players sit at opposite ends of the board, as in chess, and (from the perspective of each player) the eight rows of squares are referred to as the first, second, third, fourth, fifth, sixth, seventh, eighth ranks in ascending order of distance.

The following rules govern the placement and movement of pjawns:

*Placing pjawns on the board*

A pjawn can be placed on the board, on the first rank only, in any column where the four squares in ranks one, two, three and four are all vacant.

*Moving pjawns*

Pjawns move and capture in much the same way as pawns in chess. A pjawn that is on the first rank may move one or two squares forward in its column provided that the relevant squares are vacant, or move to capture an opponent's pjawn in an adjacent column on the second rank. A pjawn on any other rank may move forward one square only, either to occupy a vacant square in its column, or to capture an opponent's pjawn in an adjacent column, subject to the additional constraint that a pjawn may only pass from the fourth to the fifth rank if (prior to the move) there is at least one other pjawn of the same colour also at the fourth rank. The analogue of the en passant rule in chess also applies: a pjawn on the first rank that advances two squares, and in the process passes over a square where it might have been captured by an opponent's pjawn, can be captured, on the immediately following turn only, as if it had advanced only one square. A captured pjawn is removed from the board and (unlike in chess) is returned to the opponent and can be reintroduced into play.

*Winning the game*

The game ends when a pjawn reaches the eighth rank, or a player has no valid move. A player whose pjawn reaches the eight rank wins the game. A player who has no valid move loses the game.

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[*] The derivation of the name 'pjawn' is uncertain. The game was once thought to have originated in a mountain region of Scandinavia, and to have become extinct early in the 17th century. Other scholars have suggested that the 'j' was introduced into 'pawn' by the subsequently anonymous Victorian vicar who is credited with the rediscovery and popularisation of the game. Recent research, which suggests that Pjawns should be pronounced with a silent 'p', has cast some doubt on both these theories.

## Supplementary information for the Module assignment

The basic expectation of RU-BOARD? is that you will be able use EM principles and tools to construct a model of Pjawns that can be used to demonstrate the game in play and explore and document some features of the game as it stands and some of the implications of making changes to its design. Whilst you will not be expected to develop Pjawn models using any other computer modelling paradigm or framework (this is the task of other consultants), any insight you can give into the particular characteristics – both in terms of qualities and drawbacks - of an EM approach will be appreciated. You will also no doubt encounter some problems and limitations in using EM tools in the development, and your reflections on these will provide useful context for your broader evaluation of EM.

In your response to the RU-BOARD? Board you are encouraged to complement your basic implementation of a model of Pjawns by putting particular emphasis on specific features of the modelling of your own choice. For instance, you may wish to stress issues such as studying playing strategies, designing the board and pieces, supplying a convenient interface for the game-modelling activity, developing a database for recording games, an environment for annotating games, or a problem solver for varieties of Pjawn problem. Provided that your work includes a significant original individual component - such as might be supplied by a special emphasis of this nature - cooperative work, collaborative modelling and borrowing from existing models are all legitimate provided that it is properly motivated and acknowledged.

In recording Pjawn games, you are of course free to devise notations of your own choice, but you may prefer to adopt the classical notation for play illustrated in the following opening fragment of play[*]:

| White | Black |
|-------|-------|
| D1    | D8    |
| D1-D3 | E8    |
| D3-D4 | F8    |
| E1    | D8-D6 |
| E1-E3 | E8-E6 |

The public directories (~wmb/public/projects/games/ and ~empublic/projects) contain several models that can be usefully studied as background resources. In addition to the models draughtsRawles1997, oxoJoy1994 and oxoGardner1999, these include
>    The Great Game of Britain (GGB) implemented by Simon Yung in 1998
>    Fox and Hounds (FandHs) implemented by Hansel D'Ornellas in 1998
>    Variations on OXO-like games to be found in OXO/EDEN and OXO/PASCAL
within subdirectories of ~wmb/public/projects/games/

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[*] This opening was immortalised in a famous game between the two greatest Pjawn exponents of the 20th century, the twin stars affectionately known to their fans as Bjorn and Bjorn Again.