A MARKOVIAN EVALUATION OF A TERTIARY EDUCATION FACULTY

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ABSTRACT

A tertiary education faculty is modelled using an absorbing Markov chain. The model takes account explicitly of full-time and part-time student stocks and flows, and thus facilitates some interesting observations. The evaluation of steady state statistics, gives rise to some worrying results, raising the question as to how efficiently resources are being utilized in tertiary (post secondary) education. The above evaluation is performed for undergraduate sections of the Faculty of Business at the Swinburne Institute of Technology (SIT), Victoria, Australia.

1. Introduction

Tertiary education in Australia from the 1970s onwards has seen changes inflicted on almost all of its aspects. The early 1970s saw an expansion of operations of the tertiary sector while in the early 1980s, a reduction (at best a levelling off) in tertiary activity has been seen. Barcan (1978) elaborates on the specific problems by observing that

... while supply was increasing demand was falling. The hardening economic climate and the growing disenchantment of many adolescents with tertiary education produced a levelling off of enrollments at the beginning of 1977 (p. 39).

The problems faced by the tertiary education sector over the last decade are faced by individual faculties within tertiary institutions, often with far greater implications. Planning and evaluation have always been important functions, but during lean or troubled times, these tasks become a necessity for survival.

In order to assist and facilitate the planning function, an absorbing Markov chain model has been “fitted” to the Faculty of Business, purporting to represent
the stocks and flows of undergraduate students. The building of such a model facilitates a better understanding of the overall operation and problems of the Faculty and assists in the allocation of resources to meet Faculty objectives. The results in this article may be of value and interest to other faculty planners in other tertiary institutions, and also provide a basis for Markovian comparison.

2. The Markov Model of the Faculty

The stocks and flows of students within an undergraduate faculty are well suited to being modelled by a deterministic absorbing Markov chain. Examples of Markovian models applied to education systems, at higher levels of aggregation, (i.e., above faculty level) abound. Amongst the more prominent are, Gani (1963), Thonstadt (1976), Stone (1972) and Uche (1978) who all modelled national educational systems (including tertiary), while Burke (1972) applied his model to essentially a State level and Marshall (1973) to a university (although not strictly Markovian in the same context as the former applications).

The Faculty of Business at SIT offers at the undergraduate level a three year full-time (six year part-time) tertiary course leading to a bachelor/diploma of business. A small number of students undertake a two year full-time associate diploma course. The part-time stocks and flows are modelled explicitly rather than using the problematic “equivalent full-time” approach. A consequential problem associated with this approach is that of exemptions, i.e., the “crediting” to students of a unit or units of the course based on their previous tertiary or work experience. Difficulties were experienced with the correct assignment of students to their appropriate categories in the model upon “recruitment”. This was overcome however, by the use of a data collection and processing programme (the Student Transition Program). This programme also facilitated the handling of 25,000 students records covering the period 1977 to 1980, thus facilitating the obtaining of more accurate and representative estimates for the Markov model parameters.

All stocks and flows are as at 30th April of each academic year, the official census date for tertiary institutions in Australia.

The Markov model of the faculty is as follows;

\[ n_j(t+1) = \sum_{i=1}^{r} n_i(t) q_{ij} + R_j(t+1) \quad (j = 1, 2, \ldots, r) \]  

The “fitting” of the Markov chain requires estimates to be obtained for \( q_{ij} \) (the transition proportions) and data to be established for \( n_i(t) \) (the stocks of students in state \( i \) at time \( t \)) and \( R_j(t+1) \) (the recruitment of students into state \( j \) at time \( t+1 \)).