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INCREASING EFFICIENCY OF MANAGEMENT SKILL ASSESSMENT

Edward M. Pogossian, Academy of Sciences and American University of Armenia

ABSTRACT

A system of assumptions was introduced in Pogossian (*ABSEL98*) to shape an adequate model of the management skill assessment by simulation games. Under that assumptions and the quasi-transitivity constraint a theorem is formulated to find the solution of the problem with available computational resources and to overcome the obstacle of a complexity of that measuring process.

EFFICIENT ASSESSMENT FOR QUASITRANSITIVE TOURNAMENTS

1. We refine management skill assessment problems as the following.

Managers are competing in oligopoly markets for the same objectives, or criteria K , e.g. profit, market share, Return On Investment (ROI), etc. Integrative performance of managers in possible competitions is evaluating by a methodology M.

We suppose that on-the-job, performance of managers, Anderson, Cannon, Malik. and Thavikulwat (98), *is inducing a linear, or "ideal", ordering O*(K,M) of all managers.*
At the **Management Skill Assessment (MSA)** problem given managers C1,C2,...,Cm, criteria K and methodology M of an assessment of a competition it *is required* to find an ordering O (K,M) of the C1, C2,…,Cm that would be isomorphically imbedded into the "ideal" ordering O*(K, M).

Since the ideal ordering of strategies based on their game performances or tournaments is a hard problem, Pogossian (*ABSEL98*), the question of appropriate *constraints* becomes vital for reducing the complexity.

To introduce constraints we need to standardize the sets of tournaments for each competitor. In fact, each competitor C competes against samples of all possible strategies of other competitors, i.e. against all strategies, except its own ones. To regularize analysis we suppose that C competes against its copy, or the twin too.

Assumption. *Each competitor competes against all strategies including its own.*

Thus, to get the ordering O(K,M) we may construct the **Matrix of Grades** (**MG**), Pogossian (ABSEL98), where each row corresponds a competitor and each value in the row is determined by the results of the game of the corresponding competitor against one of possible samples of competitors in oligopoly competition from all possible initial situations.

2. To reduce the search we use **the Transitivity Constraint** (**TC)** to the ordering O*(K,M) which is formulating as the following
Assumption TC. Given programs Pi , Pj and sets of samples of strategies Bi and Bj losing to Pi and Pj , correspondingly, we have a tautology Pi *is stronger than* Pj with respect to the ordering O*(K,M) *if and only if* Bi *includes* Bj

TC is based on the assumption that *all competitors are essentially different in their skills.*
Thus, to order Pi and Pj in frame of the Transitivity Constraint ***it is enough to find a sample of competitors that loses to Pi and wins Pj.***

3. *Let us analyze a more general than the Transitivity Constraint case where competitors may be close each to others by their skill level or even belong to the same class of equivalence in the O*(K,M).*

Given competitor i is stronger than competitor j in the O*(K,M) denote by B(i,j) the set of samples such that i competitor loses to and j wins each sample of the B(i,j). Other words, B(i,j) is the set of samples which in the games with the programs i and j attain results not consistent, or opposite,

to the fact that i is stronger than j in the ordering. Following the Elo (78), we may accept that for fixed i and varying j *the variance function* #B(i.j) - the number of elements in B(i,j) , will have a form of normal distribution with respect to the distance between positions of i and j in the O*(K,M).

If for a given set of competitors the variance B(i,j) is not zero then we can not apply the Transitivity Constraint deterministically but only with some probability. The relevance of the Transitivity Constraint increases if the distance between compared competitors i and j is increasing.
As a first step in simulation of the competition we approximate the normal distribution by rectangular curve and formulate the following *weak* version of the Transitivity Constraint - the **Quasi-Transitivity Constraint** (QTCw).

Assumption QTCw Given programs Pi and Pj , samples of strategies Bi and Bj loosing to Pi and Pj , correspondingly, and the variance function #B(i,j) it is possible to indicate a constants *a* and *b* (small enough compared to the number of all strategies in the ordering O*(K,M)) such that:

- *if j belongs to the segment [i+a ,i-a] then #B(i,j) may exceed zero for no more than b points*
- *if j does not belong to the segment [i+a ,i-a] then #B(i,j) is equal to zero and Pi is stronger than Pj with respect to the ordering O*(K,M) if and only if Bi includes Bj.*

QTCw appears as an analog to the "essentially improved" strategies criterion in Pogossian (ABSEL97).

The following theorem is true.
Theorem. *Given a class F of competitors satisfying to the Quasi-Transitivity Constraint in its weak form and strategies f and g from F , we say that f is stronger than g (i.e. the location of f is better than g in the ideal ordering O*(K,M)) if we find b samples of competitors' strategies such that f wins and g loses games against each of them.*

The proof of the theorem is similar to the one in Pogossian (83) for two-person games with perfect information.

Thus, given the competitor f, the question of its strength relative to the competitor g is reduced to the construction of a special tournament and an estimation of the parameter b . Even without the estimate of b it is true that with increasing the number of testing samples the probability of f to be stronger than g increases too.

The theorem also supplies the necessary basis for an experimental investigation and a complete justification of the assumption .

4. *Is the Quasi- Transitivity Constraint reasonable for managers?*
The Quasi-Transitivity Constraint appears naturally if considered for knowledge-based human activities, i.e. depending on the amount of knowledge or skill available for the decision making.

For managers in general as well as for marketing managers discussed in the Pogossian (97), we may support the above statement by following arguments.

First, management strategies are essentially knowledge-based. It is evident when we analyse the methodology of the construction of business or marketing plans: experienced manager differs from a novice first of all by the amount of knowledge he uses for planning.

Second, the skill of a manager is determined not only by the amount of the acquired homogeneous knowledge but, primarily, by the hierarchy of abstractions such that each new level is possible on the base of categories from the previous levels. This property strongly correlates with the ability of managers to improve their skills.

And at last, in the real management practice there are evaluations and classifications of the managers' skill which are directly reflected by the system of their rewards.

References available from: epogossi@aua.am