Linnæus University
Sweden

I. IDENTIFICATION DATA :

Job Title : Quantum Model of Uncertainty for Dynamic Decision Making

Author Name : Bc. Aleksej Gaj

Type of work : Master's Thesis

Faculty : FNSPE CTU in Prague, Czech Republic

Department : Department Mathematics

Opponent : Prof. Andrei Khrennikov

Opponent Workplace:Linnaeus University, 2049, Hus B, Växjö, Sweeden

II. EVALUATION OF INDIVIDUAL CRITERIVA :

Assignment: more difficult

The thesis is devoted to quantum-like modeling of decision making – the novel area of research combining the methods and methodology of quantum theory, probability theory, theory of dynamical systems. The assignments are nontrivial and demanding The thesis is really a novel and valuable contribution to modelling of decision making within the mathematical formalism of quantum theory.

Task completion: done

The assignments were fulfilled in the outstanding way. It is really surprising that a student was able to work in such multi-disciplinary area of research, to construct an interesting and novel model and to perform nontrivial mathematical calculations.

Selected solution procedure: suitable

The dynamical decision system elaborated in the thesis is methodologically and mathematically correct and matches with quantum measurement theory.

Formal and language level: choice from :excellent

The thesis is well structured and the complex task of merging decision making and quantum measurement theory within one mathematical model is successfully performed. Nevertheless, it should be noted that the thesis might be even more advanced, by connecting its model with theory of open quantum systems and theory of quantum instruments. Appealing to Everet's approach to observations is good from the general methodological viewpoint, but the use of open quantum systems theory would strengthen the mathematical component of the model.

Selection of sources, correctness of citations: excellent :

Generally the list of references covers the field of quantum-like modeling sufficiently well.

More comments and ratings:
The level of the thesis is very high, it can serve as good skeleton ´of a PhD-thesis

III. OVERALL ASSESSMENT, DEFENSE QUESTIONS, SUGGESTED GRADE :

Overall my judgment of the thesis is very positive.

Possible Questions for defense:

Operators H_t used in the exponential representation of the unitary operators: it seems that one should proceed under condition of their commutativity? i.e., that $[H_t, H_s] = 0$.

Your basic equation is the Schrödinger equation (3.31). In the finite dimensional case its solution would generally fluctuate forever. Is it not an obstacle for getting a decision in finite time?

I evaluate the submitted research work by the grade level: A- excellent

Date: 11.01.2024

Signature: