ISBN 978-979-19256-0-0

visit indonesia 2008

PROCEEDING

THE 3RD INTERNATIONAL CONFERENCE ON MATHEMATICS AND STATISTICS

BOGOR, 5 – 6 AUGUST 2008

Mathematics and Statistics: bridge for academia, business, and government in the entrepreneurial era

3rd ICoMS 2008

PROCEEDING

THE 3RD INTERNATIONAL CONFERENCE ON MATHEMATICS AND STATISTICS

BOGOR, 5 – 6 AUGUST 2008

Mathematics and Statistics: bridge for academia, business, and government in the entrepreneurial era

organized by

MSMSSEA (Moslems Statisticians and Mathematicians Society in South East Asia)

Department of Statistics
Department of Mathematics
Institut Pertanian Bogor

Department of Mathematics
Universiti Malaysia Terengganu,
Malaysia

PREFACE

Assalaamu'alaikum warahmatullaahi wabarakaatuh

Welcome all participants of ICoMS 2008 to Bogor – Indonesia. This event is organized by MSMSSEA in collaboration with Institut Pertanian Bogor (Indonesia) and Universiti Malaysia Terenganu (Malaysia).

We, the organizing committee, are very glad having this international conference due to many reasons.

1. ICoMS is a good avenue for mathematicians, statisticians, and other scientist to communicate.
2. ICoMS 2008 has a theme related to entrepreneurial era which is very important for mathematicians and statisticians, and scientist in general.
3. The event is important venue for business group, government, and academia to communicate and share knowledge as well.
4. Bogor is beautiful place in Indonesia surrounded by many research centers, IPB, Botanical garden, an other point of interest related to research institution.

We are also happy that the Vice President of Republic of Indonesia, Ministry of National Education, Ministry of Energy and Mineral Resources, and Ministry of Communication and Information Technology are supporting to the ICoMS 2008.

This event held on two days, August 5-6, and consist of several parts. We invite 17 outstanding professors to share and discuss topics in mathematics and statistics, including application. As many as 170 paper and 30 posters presented during this two-day conference. We appreciate to all of contributor from various countries who are motivated to participate in this event.

High appreciation is also awarded to companies and agencies which facilitate so that the even could run well.

We really hope all participants can benefit many things from this international event. May God bless you.

Wa'alaikumsalam warahmatullaahi wabarakaatuh.

The Committee of ICoMS 2008

CONTENTS

SESSION B

SESSION C

SESSION D

SESSION E

SESSION F

POSTER

Speech of Director General of Higher Education at ICoMS 2008
At Novotel Corralia, Bogor, 5 August 2008

Dr. Fasli Jalal
The Director General of Higher Education
Ministry of National Education, Republic of Indonesia

Bismillahirrahmanirrahim
Assalamu'alaikum Warrahmatullahiwabaraktuh

Good morning ladies and gentlemen
It is a great honor for me to provide a speech in this important scientific event, the Third International Conference on Mathematics and Statistics of MSMSSEA (Muslim Statistician and Mathematician Society in South East Asia). I can see from here that the audiences are of from various countries. So, let me welcome you to Indonesia, a country of great diversity in unity. I think it likes mathematics and statistics that we always find diversities and similarities. As far as I know that these two terms that make science and technology develop rapidly.

Someday a Germany great scientist, who found the Normal Distribution, Carl Fredric Gauss (1777-1855), had mentioned that mathematics, is the queen and servant of science. It is very reasonable statement, becuase mathematics plays an important role in developing science and technology and in the same time it must be reconed in all aspects of science production, preservation and dissemination. Hence, it is a servant of science. In the other hand, all scientists, irrespective their domains have to understand mathematics (including statistics) in order to analyze the problems properly. Thus, it is a queen of science. With its two functions, mathematics with its derivatives has narrowed the gap between the so called hard science and soft science. Hence, there is no exact distinctin between soft and hard sciences. Whatever the sciences, they need mathematics and statistics in order to clarify and simplify the issues. In mathematics and statistics, simplicity is the clarity of mind. However, mathematics and statistics can analyze complex issues. The modelling itself is the simplication of complicated real world.

Ladies and gentlemen
Let me talk about about sscience, mathematics and technology which are well-known as the tripod in an unknown area. All scientists who have achieved high standing positions in science reputation always have strong mathematical background. Hence, they can see the things that the other people can't see, also they can predict that the other people can't predict. Their deductive as well as inductive thinking are both adequate. These two ways of thinking are essential in research and science development. Deductive reasoning is considered mathematical way of thinking, while inductive is statistical way of thinking. Both type of reasoning are the key factors of scientific circle, without them the science development is stagnant. The Kuhnian model of scientific revolution occures when the deductive and inductive thinking are accomodated well in a society. Hence, education has to provide great room for student to flourish their reasoning. Their brain for deductive and inductive thinking can develop if the school gives enough space for student creativity. Hence, they can think freely and try to find facts, which are called data in the statistical term, to proof their ideas. A great Indonesian statistician, Prof. Nasoetion (1932-2002), someday mentioned 'In God we trust, all other bring data'.

The challenges are to find the ways in order to facilitate the students to love science and mathematics. After they love and understand the important of science and mathematics as well as stimulated by realities, finally they can develop technologies. Hence, the three point of the tripod are interconnected and progess well in a conducive ecosystem. Many technological problems influence the mathematical and science development, and at the end have made the society developed and their income increased. However, the conducive academic atmospehere is needed in order the tripod of science, mathematics, and technologies can develop well. For example, the problems of communication and information have made topology, number theory, and graph theory which are needed in developing information technology. This phenomenon has created big market for the mathematicians and statisticians. Finally, without strong mathematics (including statistics) the technologies as well as the economy are stuck. In other word, there is no great economy without great mathematics and science. Hence the economic development is termed as knowledge-based economy or K-economy. There is no K-economy in society with poor knowledge. In other words, K-economy can only develop well in the society, who understand knowledge. This society is called knowledge-based society or K-society. I am sure that all scientists in this room agree with me that the developing countries have to be the K-society in order to lead the world. Otherwise, we are only the followers.

Ladies and gentlemen.
I understand that one of the clusters in theis conference is 'mathematics in education processes. I believe this is very important for scientist and professors of higher education to pay enough attention to the basic and secondary education, especially in cultivating the important of mathematics and science for emerging technologies. Students with poor comprehension of mathematics can be predicted will have difficulties in facing complex subjects. Therefore, the universities have obligations to make the basic and secondary education understand well the fundamental principles of mathematics including their mathematical skills. Since the pupils are the main sources of the future scientists and technologists, their foundation in basic science and mathematics is greatly important. Hence, interesting method of subject delivery is key factor for the pupils to comprehend mathematics. So, one of important services of higher education to society is to train the teacher of lower education in order to follow new frontier of science. They need to be up dated. This service has direct and indirect positive effect to the universities. The direct effect is to obtain high quality of student intake, while the indirect one is to share knowledge to the society.

I fully agree with the theme of the third ICoMS "mathematics and statistics as a bridge for academia, government and business in the entrepreneurial era". This theme implies some consequences, such as: mathematics and statistics are not just passive subject to be learned or memorized, they must be considered as active materials to be understand creatively and hence finally the scientists can produce mathematics and statistics. In other words, students have to learn mathematics and statistics actively including the basic theory and their application. It is understood that inside the airplane there exist complex mathematics and statistics. Without strong mathematics and statistics, the airplane cannot fly appropriately. This example can be extended into many areas of life and technologies, including medicine, social sciences, economy, business, politics, public health, biotechnology, manufacturing, civil engineering, energy, and so on. However, to produce mathematics and statistics needs entrepreneurial soul. Hence collaboration among stakeholder from various institutions is needed in approaching the complex issues in the entrepreneurial era.

For our fellows from the private sectors, one easy way to help mathematicians and statisticians is to provide education programs on CSR (Corporate Social Responsibily). For example we can build a mathematics fellowship program, mathematics and statistics entrepreneurial award, entrepreneurial rsearch competition, and many other thins. For implementing these ideas, we are more than happy to collaborate with the private sectors.

Ladies and gentlemen
At the present time, almost all countries are shifting their concept of development from centralism to decentralism. The paradigm shift is also recognized by international bodies, like The World Bank. Hence, the role of scientists including mathematicians and statisticians are getting crucial. Why? Because regional development without strong human resource is difficult. The local governments certainly need knowledge for their regional planning. Mathematicians and statisticians can collaborate with the local government in creating and measuring some tangible indicators for government strategic planning and road mapping. Otherwise, the plan is too normative and uneasy to measure. As a result, the progress of development cannot be evaluated objectively. Number is not everything in lives, but lives without number is nothing. Hence, cooperative action among academia, government and business is 'a must'.

To optimize the opportunity, let me provide you some assignment to formulate what is the role of mathematicians and statisticians in the economic holistic development. While you are presenting your research papers, maximize your present here to have such discussion on mathematics related to regional development, entrepeneruship, environment, food and energy resources including the process of education and research. It looks simple but needs a well trained mathematicians and statistician like you all. I believe you can produce innovative approaches which are useful for the Indonesian government, universities, research centers, private sectors, and other community. Your thought is surely needed by other participants coming from various countries.

Finally, I envoy my deep gratitude while hoping you enjoy this conference and other activities organized by MSMSSEA. I hope you are always fresh and health with full enthusiasm in participating the important event.

Selamat berkonferensi dan terima kasih.

Billahittaufiq wal hidayah
Wassalamu'alaikum warahmatullahi wabarakatuh
Dr. Fasli Jalal

GENERATING CLAIM DATA OF GENERAL INSURANCE BASED ON COLLECTIVE RISK MODEL AND CLAIM PROCESS

[1]Aceng K. Mutaqin, [2]Dumaria R. Tampubolon, [2]Sutawanir Darwis

[1]Student of doctoral program at Department of Mathematics,
Institut Teknologi Bandung

[2]Lecturer at Department of Mathematics,
Institut Teknologi Bandung

e-mail: [1]s307_aceng@students.itb.ac.id, [2]dumaria@itb.ac.id, and [3]sdarwis@itb.ac.id

Abstract: *Meyers and Schenker (1984) presented algorithms to generate claim data of general insurance based on collective risk model. The components that generated are claim frequency and claim severity. In this paper, we propose two algorithms to generate claim data of general insurance based on collective risk model and claim process. The algorithm not only generating claim frequency and claim severity, but also time of claim events and time of claim payments. The first algorithm is particularly useful in short-tail insurance business. The second algorithm is particularly useful in long-tail insurance business. In this paper, the algorithms illustrated by generating claim data of general insurance using MATLAB program.*

Keywords: *general insurance, collective risk model, claim process, claim frequency, claim severity, long-tail insurance business, MATLAB program*

1. Introduction

In business of general insurance, claim data are very important for pricing and reserving. Taylor and McGuire (2004) reported that claim data usually containing date of injury; date of notification; finalized/unfinalized status, including dates of changes of status; paid losses; case estimates; and various other claim characteristics (e.g. injury type, injury severity, etc.).

Meyers and Schenker (1984) presented algorithms to generate claim data of general insurance based on collective risk model. The components that generated are claim frequency and claim severity. In this paper, we propose a new algorithm to generate claim data of general insurance based on collective risk model and claim process. The algorithm not only generating claim frequency and claim severity, but also time of claim events and time of claim payments. The algorithm is particularly useful in long-tail insurance business for testing or comparing performance of one or more methods of pricing and reserving. In this paper, claim process means claim payment process. The algorithm is illustrated by generating claim data of general insurance using MATLAB program.

The remainder of the paper is structured as follows. Section 2 presents the Meyer-Schenker's algorithm. The proposed algorithm is discussed in Section 3. Section 4 provides an example to illustrate the proposed algorithm in MATLAB program.

2. Meyers-Schenker's algorithms

Meyers and Schenker (1984) presented three algorithms to generate claim data of general insurance based on collective risk model. Let N be a random variable denoting the claim frequency, λ be the expected claim frequency, and χ be a random variable with $E[\chi] = 1$ and $Var[\chi] = c$. The claim frequency distribution can be modeled by the following algorithm.

Algorithm 1

1. Select χ at random from the assumed distribution.
2. Select the claim frequency, N, at random from a Poisson distribution with parameter $\chi \cdot \lambda$.

If χ has a Gamma distribution, the claim frequency distribution described by Algorithm 1 is the negative binomial distribution (Klugman *et al*., (2004)). Meyers and Schenker (1984) called the parameter c is the contagion parameter for the claim frequency distribution. If $c = 0$, **Algorithm 1** yields the Poisson distribution.

Let Z be a random variable denoting claim severity, $S(z)$ be the cumulative distribution function for the claim severity, z, and X be a random variable denoting the aggregate loss for an insured. Aggregate losses can then be generated by the following algorithm.

Algorithm 2

1. Select the claim frequency, N, at random from the assumed claim frequency distribution.
2. Do the following N times.
   2.1. Select the claim severity, Z, at random from the assumed claim severity distribution.
3. The aggregate loss amount for an insured, X, is the sum of all claim severity, Z, selected in Step 2.1.

Implicit in the use of **Algorithm 2** is the assumption that the claim severity distribution, $S(z)$, is known. In practice, this distribution must be estimated from historical observations, or it must be simply assumed. Under such conditions, errors in selecting the parameters of the claim severity are inevitable. To model parameter uncertainty in the claim severity distribution, Meyers and Schenker (1984) made the simplifying assumption that the shape of the distribution is known, but there is uncertainty in the scale of the distribution.

Let β be a random variable satisfying the conditions $E[1/\beta] = 1$ and $\mathrm{Var}[l/\beta] = b$, then the aggregate losses amount for an insured modeled by the following algorithm.

Algorithm 3

1. Select the claim frequency, N, at random from the assumed claim frequency distribution.
2. Select the scaling parameter, β, at random from the assumed distribution.
3. Do the following N times.
   3.1. Select the claim severity, Z, at random from the assumed claim severity distribution.
4. The aggregate loss amount for an insured, X, is the sum of all claim severity, Z, divided by the scaling parameter, β.

Meyers and Schenker (1984) called β is the mixing parameter. The mixing parameter is a measure of parameter uncertainty for the claim severity distribution.

3. The proposed algorithms

In this section, we propose two algorithms to generate claim data. The first algorithm is extension of **Algorithm 3** by adding time of claim events. Let $T1$ be a random variable denoting the time between claims, then the algorithm to generate claim frequency, claim severity, and time of claim events is as follows.

Algorithm 4

1. Select the claim frequency, N, at random from the assumed claim frequency distribution.
2. Select the scaling parameter, β, at random from the assumed distribution.
3. Do the following N times.
   3.1. Select the time between claims, $T1$, at random from the assumed time between claims distribution.
   3.2. Select the claim severity, Z, at random from the assumed claim severity distribution.
4. The aggregate loss amount for an insured, X, is the sum of all claim severity, Z, divided by the scaling parameter, β.

The **Algorithm 4** assume that a claim is finished by one payment. This algorithm is particularly useful in short-tail insurance business.

In long-tail business insurance, it is common that a claim is finished by more than one payment. The second algorithm is particularly useful in long-tail insurance business. Let $T2$ be a random variable denoting the time between payments, and *M* be a random variable denoting the number of payments, then the algorithm to generate claim frequency, claim severity, time of claim events, and time of claim payments is as follows.

Algorithm 5

1. Select the number of claims, *N*, at random from the assumed claim frequency distribution.
2. Do the following *N* times.
   2.1. Select the scaling parameter, β, at random from the assumed distribution.
   2.2. Select the time between claims, *T*1, at random from the assumed time between claims distribution.
   2.3. Select the number of payments, *M*, at random from the assumed distribution of the number of payments, then do the following *M* times.
      2.3.1. Select the time between payments, *T*1, at random from the assumed distribution of the time between claims.
      2.3.2. Select the claim severity, *Z*, at random from the assumed claim severity distribution.
   2.4. The aggregate loss amount for an insured, *X*, is the sum of all claim severity, *Z*, divided by the scaling parameter, β.

The **Algorithm 5** assume that the payments for a claim are independent.

3. Example

Two algorithms in Section 3 illustrated by generating claim data of general insurance using MATLAB program. Figure 1 display MATLAB program for **Algorithm 4**. The execution result of Figure 1 for lambda = 3, b = 0.1, and c = 0.1 shown in Table 1.

```
function [OUT,X] = ALGOR4(lambda,b,c)
chi = GAMRND(1/c,c);
N = POISSRND(chi*lambda);
beta = GAMRND(1/b+2,b/(1+b));
time = 0;
if N > 0
    for i=1:N
        T1 = EXPRND(50);
        time = time + T1;
        Z(i) = GAMRND(5,1000)/beta;
        OUT(i,1) = time;
        OUT(i,2) = Z(i);
    end
else
    Z = 0;
    OUT = 0;
end
X = sum(Z);
```

Figure 1. MATLAB Program for Algorithm 4

Table 1. Result for Figure 1

Time of Claim Event	Claim Severity
43.866	5143.4
110.79	6396.8
147.98	6700.9
TOTAL	18241.0

MATLAB program for **Algorithm 5** is available from the first author.

4. References

Klugman, S. A., Panjer, H. H., Willmot, G. E. (2004). *Loss Models: From Data to Decisions*. John Wiley & Sons: New Jersey.

Meyers G., and Schenker, N. (1984). *Parameter uncertainty in the Collective Risk Model*. www.casact.org.

Taylor, G., dan McGuire, G. (2004). *Loss Reserving with GLMs: a Case Study*. Casualty Actuarial Society 2004 Discussion Paper Program, 327-392. http://www.casact.org/pubs/dpp/dpp04/04dpp327.pdf.