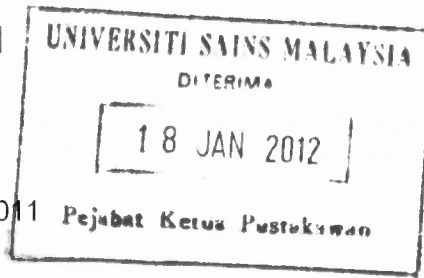




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Pejabat Pengurusan Dan Kreativiti Penyelidikan
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No. Fail : F0177

Tarikh : / Disember 2011

Profesor Abdul Rahman Othman
Pusat Pengajian Pendidikan Jarak Jauh
Universiti Sains Malaysia

Tuan,

LAPORAN AKHIR SKIM GERAN PENYELIDIKAN FUNDAMENTAL (FRGS)
Tajuk Projek : **Robust Tests Procedures using Robust Scale Estimators**
No. Akaun : **203/PJJAUH/671094**

Dengan hormatnya perkara di atas dirujuk.

2. Terlebih dahulu saya ucapkan ribuan terima kasih di atas satu salinan laporan akhir untuk projek penyelidikan seperti tajuk di atas.

3. Adalah dimaklumkan walaupun projek ini telah selesai, kerjasama Jabatan Bendahari dipohon untuk menguruskan penutupan akaun projek pada selewat-lewatnya **31 Disember 2011**. Tempoh ini bertujuan untuk menyelesaikan semua urusan tuntutan dan bayaran yang telah dibelanjakan di dalam tempoh projek. Walau bagaimanapun, tuan dinasihatkan supaya tidak mengeluarkan borang-borang pesanan baru di dalam tempoh ini.

4. Selanjutnya sila ambil perhatian terhadap perkara-perkara berikut sekiranya berkaitan:

- (i) Semua penerbitan harus merakamkan penghargaan kepada **Skim Geran Penyelidikan Fundamental (FRGS)** dan tuan dipohon mengemukakan satu salinan ke Pejabat ini.
- (ii) Bahagian Penyelidikan & Inovasi boleh/akan mengagihkan semula peralatan yang telah dibeli menggunakan peruntukan geran ini seandainya terdapat penyelidik lain yang memerlukan peralatan tersebut.

5. Akhir sekali, tahniah di atas usaha dan kejayaan pihak tuan dapat menyelesaikan projek ini dengan jayanya.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"
'Memastikan Kelestarian Hari Esok'

Yang menjalankan tugas,


(AMRA OTHMAN)
Penolong Pendaftar
Unit Pengurusan Geran & Kontrak

HAN, HAR, SIM

LAPORAN AKHIR SKIM GERAN PENYELIDIKAN FUNDAMENTAL (FRGS)


Tajuk Projek : Robust Tests Procedures using Robust Scale Estimators

No. Akaun : 203/PJJAUH/671094

s.k. Dekan Penyelidikan
Pelantar Sains Fundamental
Pejabat Pelantar Penyelidikan
Universiti Sains Malaysia

Dekan
Pusat Pengajian Pendidikan Jarak Jauh
Universiti Sains Malaysia

Timbalan Dekan
(Pengajian Siswazah & Penyelidikan)
Pusat Pengajian Pendidikan Jarak Jauh
Universiti Sains Malaysia

 Ketua Pustakawan
Perpustakaan Hamzah Sendut
Universiti Sains Malaysia

Penolong Bendahari Kanan
Unit Kumpulan Wang Penyelidikan
Jabatan Bendahari
Universiti Sains Malaysia

Pegawai Sains
Pelantar Sains Fundamental
Pejabat Pelantar Penyelidikan
Universiti Sains Malaysia

} Disampaikan satu salinan laporan akhir projek untuk simpanan Perpustakaan

} Mohon kerjasama pihak puan untuk menguruskan penutupan akaun projek selewat-lewatnya pada **31 Disember 2011** dan mohon kemukakan satu salinan penyata kewangan terakhir ke Pejabat ini untuk tujuan rekod



FINAL REPORT FUNDAMENTAL RESEARCH GRANT SCHEME (FRGS)

*Laporan Akhir Skim Geran Penyelidikan Asas (FRGS) IPT
Pindaan 1/2009*

A RESEARCH TITLE : Robust Test Procedures using Robust Scale Estimators

Tajuk Penyelidikan

PROJECT LEADER : Prof Madya Abdul Rahman Othman

Ketua Projek

**PROJECT MEMBERS : 1. Dr Noraida Abdul Ghani 4. Puan Suraiya Kassim
(including GRA) 2. Puan Hasmawati Hassan 5. Puan Zahayu Yusoff**

Ahli Projek

3. Puan Che Rohani Yacob

PROJECT ACHIEVEMENT (Projek / Projek)

B

ACHIEVEMENT PERCENTAGE			
Project progress according to milestones achieved up to this period	0 - 50%	51 - 75%	76 - 100%
Percentage			100
RESEARCH FINDINGS			
Number of articles/ manuscripts/ books	Indexed Journal		<i>Non-Indexed Journal</i>
	1		43
Paper presentations	International		<i>National</i>
	4		5
Poster presentation	1		
HUMAN CAPITAL DEVELOPMENT			
Human Capital	Number		Others (Please specify):
	On-going	Graduated	
PhD Student		1	
Masters Student		1	
Undergraduate Students			
Temporary Research Officer	1		
Temporary Research Assistant			
Total	3		

EXPENDITURE (Perbelanjaan)

C	Budget Approved (Peruntukan diluluskan)	: RM 39,000
	Amount Spent (Jumlah Perbelanjaan)	: <u>RM 39,000</u>
	Balance (Baki)	: <u>RM 0</u>
	Percentage of Amount Spent	: 100 %
	<i>(Peratusan Belanja)</i>	

ADDITIONAL RESEARCH ACTIVITIES THAT CONTRIBUTE TOWARDS DEVELOPING SOFT AND HARD SKILLS
(Aktiviti Penyelidikan Sampingan yang menyumbang kepada pembangunan kemahiran insaniah)**D**

International		
Activity	Date (Month, Year)	Organizer
1. SAS 5 th Annual Summer Program for Educators Teaching Data Mining, California State Univ., Long Beach, California, USA.	15-20 Julai 2007	SAS United States
2. 56 th Session of the International Stasitical Institute (ISI 2007), Lisboa Congress Centre, Lisbon, Portugal.	22-29 August 2007	International Stasitical Institute
3. 3 rd International Conference on Mathematical Sciences - ICM 2008, United Arab Emirates University, Al-Ain, UAE	2-6 March 2008	United Arab Emirates University
National		
Activity	Date (Month, Year)	Organizer
1. Short course on <i>Robust Statistical Methods</i> by Prof Ricardo Antonio Maronna of National University of La Plata, Argentina.	11-13 March 2008	Institute Penyelidikan Matematik, University Putra Malaysia
2. Workshop on <i>Monte Carlo Methods in Statistical Inference</i> , Computer Lab, Pusat Pengajian Sains Matematik, USM.	27-28 June 2008	Pusat Pengajian Sains Matematik, USM
3. Workshop on <i>Robust Test of Spread Database</i> , Computer Lab, Pusat Pengajian Sains Matematik, USM.	15 August 2008	Pusat Pengajian Sains Matematik, USM
4. Seminar Pemantauan Projek Penyelidikan di bawah Skim Geran Penyelidikan Fundamental (FRGS), Bella Vista Hotel, Langkawi.	14 October 2008	Kementerian Pengajian Tinggi
5. Seminar ISM 2009 - Invited Speaker, Hotel Singgahsana, Petaling Jaya, Selangor.	2 April 2009	Institute Statistik Malaysia (ISM), Universiti malaya
6. <i>Asymptotic Statistical Seminar</i>	15 April	Pusat Pengajian Sains Matematik, USM

PROBLEMS/CONSTRAINTS IF ANY (Masalah/ Kekangan sekiranya ada)**E**

RECOMMENDATION (Cadangan/Pembahbalkan)

RESEARCH ABSTRACT – Not More Than 200 Words (Abstrak Penyelidikan – Tidak Melebihi 200 patah perkataan)

When dealing with the testing of location measures, the classical tests are known to be affected by nonnormality and heteroscedasticity. Several robust statistical procedures were therefore developed to handle the problem. Among the many statistics developed, we chose to take a closer look at two of them. They are the T_1 and F_t statistics. The original T_1 was tested on symmetric but nonnormal distributions. The F_t statistic was used on nonnormal distributions with homogeneous variances. Both the T_1 and F_t statistics used a fixed amount of trimming in order to obtain the trimmed means.

In this study we modified the two statistics with three variable trimming procedures and a fixed trimmed mean procedure. In the variable trimming procedures, three scale estimators, namely MAD_n , T_n and LMS_n were used in the trimming criteria. For the fixed trimmed mean method, we used the Winsorized mean and Winsorized standard error in both statistics.

We then measured the robustness of these modified procedures by obtaining the Type I error and power rates. Several variables such as -the number of groups, balanced and unbalanced sample sizes, variance heterogeneity, pairing of group variances and group sizes, type of distribution- were manipulated in order to identify the robustness of each procedure. We can summarize the results of our study as follows.

1. The procedure where F_t was used with LMS_n has good Type I error rate in extremely skewed distribution with homogeneous variances.
2. In normal-tailed distributions with heterogeneous variances, the procedure where T_1 was used with T_n performed quite well in terms of Type I error.
3. With regard to power, the variable trimming procedures produced high power rates under the conditions of unequal sample sizes and homogeneous variances.
4. Overall, among the variable trimming procedures, F_t was better than T_1 in terms of both Type I error and power.

Date :
Tarikh

Project Leader's Signature:
Tandatangan Ketua Projek

COMMENTS, IF ANY, ENDORSEMENT BY RESEARCH MANAGEMENT CENTER (RMC)

(Komen, sekiranya ada/Pengesahan oleh Pusat Pengurusan Penyelidikan)

Name:
Nama:

Signature:
Tandatangan:

Date:
Tarikh:

PUBLICATION LIST

INTERNATIONAL

- Md Yusof, Z., Othman, A.R. & Syed Yahaya, S.S. (2008). Type I error rates of T_1 statistic. *International Journal of Mathematical Sciences and Engineering Applications (IJMSEA)*, 2(4), 305-312.
- Md Yusof, Z., Othman, A.R. & Syed Yahaya, S.S. (2007). Statistik T_1 yang diubahsuai menggunakan criteria pemangkasan berdasarkan penganggar skala teguh $MADn$. [Modified T_1 statistic using trimming criteria based on robust scale estimator $IMADn$]. In D. Mohamad, R. Ismail, M. Awang, K. I. Othman, A. M. Shahidin, A. Nik Taib, N. Salim, N. Salim, & N. H. Sarmin (Eds.), *Prosiding Simposium Kebangsaan Sains Matematik Ke-15: Sains Matematik Pemangkin Pembangunan Modal Insan [Proceedings of the Fifteenth National mathematical Sciences Symposium: Mathematical Sciences the Catalyst of Human Capital Development]*(pp. 629-634). Shah Alam, Malaysia: Universiti Teknologi Mara.
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- Md Yusof, Z., Othman, A.R. & Syed Yahaya, S.S. (2008). Detecting outliers by using trimming criterion based on robust scale estimators with SAS procedure. *Borneo Science*, 23, 21-26.
- Teh, S.Y., Md Yusof, Z., Yaacob, C.R. & Othman, A.R. (2010). Performance of the traditional pooled variance t-test against the bootstrap procedure of difference between sample means. *Malaysian Journal of Mathematical Sciences*, 4(1), 85-94. [ISSN:1823-8343].
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- Teh, S. Y. & Othman, A. R. (2008, July). Ensemble method hit ratio for robusts tests of spread. *SAS Forum 2008 Proceedings* (pp.33-37). Kuala Lumpur: SAS Malaysia.
- Yaacob, C. R., Othman, A. R., & Syed Yahaya, S. S. (2007). Power of a robust statistic in a two group design. In A. I. Md. Ismail, Y. Abu Hassan, A. Mustafa, Z. Zainuddin, H. Kamarul Haili, N. Awang & M. T. Ismail (Eds.), *Proceedings of 3rd Indonesia Malaysia Thailand – Growth Triangle (IMT-GT) Regional Conference on Mathematics, Statistics and Applications* (pp.803-806). Penang, Malaysia: Universiti Sains Malaysia.

Teh, S. Y., Othman, A. R., Keselman, H. J., & Wilcox, R. R. (2007). The biweight midvariance test of spread. In A. I. Md. Ismail, Y. Abu Hassan, A. Mustafa, Z. Zainuddin, H. Kamarul Haili, N. Awang & M. T. Ismail (Eds.), *Proceedings of 3rd IMT-GT Regional Conference on Mathematics, Statistics and Applications* (pp.987-993). Penang, Malaysia: Universiti Sains Malaysia. (3)

Papers presented but not published

Teh, S.Y. & Othman, A.R. (2008, August). *Performance evaluation of the training model for robust tests of spread using validation data set*. Poster presented at the 3rd International Conference on Mathematics and Statistics, Bogor, Indonesia.

Md. Yusof, Z., Othman, A.R. & Syed Yahaya, S.S. (2007, December). *Type I error rates of trimmed F statistic for equal population variances*. Paper presented at the 9th Islamic Countries Conference on Statistical Sciences, Concorde Hotel, Shah Alam, Selangor, Malaysia.