GOVERNMENT OF KERALA

Abstract

Higher Education – Technical · Recommendations of the Entrance Examinations Reform Committee · accepted · Orders issued

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HIGHER EDUCATION (G) DEPARTMENT

G.O (Ms) No. 223/2009/H.Edn   Dated, Thiruvananthapuram, 17 -12-2009

Read:- 1) GO (MS) No.184/05/HEdn dated 17/12/05.
     2) GO (MS) No.128/06/HEdn. dated 4/10/06

O R D E R

The question of reforming the existing Entrance Examination System has been under the active consideration of the Government. As per the GO read as 2nd paper above, Govt have re-constituted the committee with eminent Educationists for suggesting reforms to the present Entrance Examination System. The Committee submitted its report during April 2008. A series of meetings were held to discuss the reforms suggested by the Committee.

The recommendations of the Committee were as follows:

1) Multiple Choice Question Type System is not adequate to make comprehensive evaluation of student's knowledge for professional course admission. Due weightage should be given to the performance in the qualifying examination. The weightage recommended was 50%. For the first two or three years internal evaluations scores and practical examination marks should not be counted.

2) Higher Secondary Examination system and Vocational Higher Secondary examination system should be reformed in such a manner that it will give no room for its integrity and transparency being challenged. To this end several measures were suggested.

3) For comparing the marks of applications of students who had followed other systems of study, namely, CBSE, ICSE, Other Boards etc., the marks obtained was to be called for from the respective Boards.

4) The marks in the qualifying examination and Entrance Examination have to be combined. For this purpose the total marks of the candidate in the Entrance Examination should be brought to a scale of 0 to 100 and added to the total of the normalized marks of the three subjects Physics, Chemistry Mathematics/Biology in the qualifying examination after scaling and converting it to a 0 to 100 scale.

5) There should be a question bank containing several thousands of objective type questions with graded difficulty levels from which the software can generate random question papers with desired mix of difficulty gradation. The question bank development process will be undertaken by a large pool of resource persons. There will be Malayalam translation of the questions. A question bank division with several technically qualified persons have been suggested to be created at the Commissionerate of Entrance Examinations.

6) The committee suggested to establish a scholarship fund with the revenue earned through conduct of Entrance Examinations, contributions from alumini of professional colleges and from industry in and outside Kerala and non resident Indians. The fund is to be administered by an Autonomous Quasi Government Trust with representatives from industry, eminent educationists and representatives from Government.

7) The committee suggested to take a decision on the adding of marks obtained in the qualifying examination with the marks obtained in the entrance examination in consultation with legal experts.

8) Govt have taken the following actions on the report.

1) For suggesting reforms to the Higher Secondary Examination System/Vocational Higher Secondary System, a committee comprising of Dr. Jayasankar, Dr, Achuth Sankar.S. Nair, Director, Higher Secondary Education, Director, Vocational Higher Secondary Education and Joint Director, Higher Secondary Education has been constituted.

2) Dr. G.Jayasankar was authorized to hold discussions with Heads of various Boards for comparing and normalizing the marks of the examinations conducted by various Boards with that of the Kerala State Higher Secondary Examinations

3) For making suggestions of combining marks of qualifying examination and Entrance Examination and its normalisation, a committee comprising of Dr. Yageen Thomas, Dr. P. Sankaran Sharma, Dr. Somasekharan Pillai and Dr. S. Raju Krishnan has been constituted.

4) The report shall be published in the official website of the Commissioner for Entrance Examinations and suggestions invited from the public. Dr. Raju Krishnan was authorized to co-ordinate this.

5) In the case of SC/ST candidates first five attempts shall be considered as first chance. In case of SEBC candidates first three attempts will be considered as first chance for General categories first two attempts will be treated as first chance.

6) The reforms in the entrance examination may be introduced from the academic year 2010-2011.

7) The marks obtained in the second year examination of +2 alone may be

counted for the academic year 2010-2011.

8) There will be no change in the examination centres for HSC and VHSE students this year.

9) Candidates who have already attempted entrance examination two times will be given opportunity to write the reformed examination system, two more times.

Government have examined the report in detail and are pleased to accept the recommendation of the Entrance Examinations Reform Committee in principle. Government also approve the actions so far taken on the recommendations of the Committee. Report of the Committee and minutes of the meetings held by Govt in this regard are enclosed. The Law Department is authorized to draft a legislation on the above lines and ensure its introduction as a Bill in the coming Assembly Session.
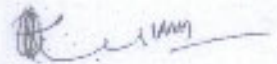
(BY ORDER OF THE GOVERNOR)

KURUVILA JOHN
Principal Secretary to Government

To

The Commissioner for Entrance Examinations, Thiruvananthapuram.
The Director of Technical Education, Thiruvananthapuram.
The Accountant General (A&E) (Audit),Kerala, Thiruvananthapuram.
The Manager, Justice PA Mohammed Committee, Old High Court Building, Ernakulam.
The Registrars, Kerala University/MG University/ CUSAT/ Calicut University/ Kannur University.

forwarded/By Order,

Section Officer

REPORT OF THE
ENTRANCE EXAMINATIONS REFORMS COMMITTEE

GOVERNMENT OF KERALA

APRIL 2008

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Background

The Commissioner of Entrance Examinations in Kerala has been entrusted with the responsibility of conducting the entrance examinations, selecting the candidates based on the criteria of merit and communal reservations, and assigning them to the various professional colleges. The Commissionerate of Entrance Examinations was established in 1983. Currently, the Commissioner conducts examinations for the following Undergraduate Professional Courses:

Engineering Colleges

    Bachelor of Technology (B.Tech)

    B. Tech (Agricultural Engineering)

    B. Tech (Dairy Science and Technology)

Architecture Courses

    Bachelor of Architecture (B. Arch)

Medical Courses

    Bachelor of Medicine and Bachelor of Surgery (MBBS)

    Bachelor of Dental Surgery (BDS)

    Bachelor of Science Nursing (B. Sc Nursing)

    Bachelor of Science — Medical Laboratory Technology

    Bachelor of Ayurvedic Medicine and Surgery

    Bachelor of Siddha Medicine and Surgery

    Bachelor of Homoeopathic Medicine and Surgery

    B. Sc Nursing (Ayurveda)

    B. Pharm (Ayurveda)

    Bachelor of Physiotherapy

Agricultural and Allied Courses

    Bachelor of Science - Agriculture

    Bachelor of Fisheries Science

    Bachelor of Science - Forestry

Veterinary Course

    Bachelor of Veterinary Science and Animal Husbandry

Admissions to these courses other than the Architecture Course are on the basis of merit as assessed in the Engineering/Medical Entrance Examinations conducted by the Commissioner for Entrance Examinations. As directed by the Council of Architecture, India, admissions to the Architecture Course are based on a combined score with equal weightage for the marks in the qualifying examination and the marks obtained in the National Aptitude Test in Architecture conducted by the National Institute of Advanced Studies in Architecture (NIAS).

An expert committee constituted by Government of Kerala (vide G.O. (Ms.) No. 11 1/99/H.Edn dated 20.9.99) was constituted to study the existing system at that time and submit their recommendations for changes if any required in the set up. This Committee recommended major changes in the Common Entrance Test in 1999. Based on the recommendations of this Committee, separate Entrance Examinations were held for Engineering and Medical Streams from 2000 onwards. The Engineering Entrance Examination consists of two papers: Paper I — Physics and Chemistry and Paper II — Mathematics with questions in Mathematics, Physics and Chemistry in the ratio 5:3:2. The Medical Entrance Examination consists of two papers: Paper I — Chemistry and Physics and Paper II — Biology with questions in Biology. The four papers are of the 'Objective' type with 120 questions and 5 distracters for each question.

Appointment of the Present Committee

Government in G.O (Ms.) No. 128/2006 dated 4.10.2006 constituted a Committee consisting of the following members with the objective of suggesting reforms in the Entrance Examination system:

Dr. M. P. Chandrasekharan

Dr. C. R. Soman

Dr. R. V. G. Menon

Prof. G. Jayasankar

Dr. Achuthsankar S. Nair

Commissioner for Entrance Examination

Principal Secretary (Higher Education)

The Committee submitted its interim report in December 2006. The Committee had in this interim report outlined the issues for consideration and the rationale for a reform in the entrance examination system. They are not reproduced here in this final report.

The Committee had several rounds of discussions. A one-day workshop of academicians and resource persons was held on 15 March 2008, to discuss the modalities of introducing a Question Bank.

The Committee also had the benefit of the advice of an Expert Group of Statisticians. Their report is appended hereto as an annexure.

Recommendations

1. Weightage for Plus Two Marks

1. The comprehensive educational experience expected out of the higher secondary education is being side lined and the committee feels that this is detrimental to education at large. The current exclusive MCQ-based examinations cannot be comprehensive in assessing student knowledge and encourages drill-based training by students. This in turn, leads to discrimination in favour of those who can afford high value special coaching for this purpose. The committee also feels that the MCQ type exam is not adequate to make comprehensive evaluation of student knowledge for professional course admission. Due weightage should be given to the performance in the qualifying exams: This weightage is recommended as 50%. In view of the fact that the evaluation system of the Higher Secondary Examination System is itself in its infancy, only the Marks / Grades for the Theory papers (Physics, Chemistry, Maths / Biology) of the Final Examination of the Qualifying Course is to be considered to begin with. This would mean that in the first two to three years, the Internal Evaluation scores and Practical Examination marks should not be counted.

Once the reforms in the Higher Secondary Education suggested below are implemented, and the internal evaluation system attains a higher degree of robustness and objectivity, Government may use the Internal Evaluation and Practical Examination marks also for admissions to the Professional Colleges of Kerala.

2. **Reforms in the Higher Secondary Examination System conducted by the Government of Kerala**

The Committee felt that one pre-requisite for the introduction of assigning weightage for Plus Two marks is a reform in the Higher Secondary Examination system. It is necessary to keep in mind the circumstances that led to the introduction of the Entrance Examination in 1983 in the wake of widespread malpractices in the evaluation in the Pie-Degree System. Therefore, it is imperative that the conduct of Plus Two Exam and VHSE is reformed with immediate effect in a manner that will give no room for its integrity and transparency being challenged. The Higher Secondary Examination should be conducted with all the seriousness of an Entrance Examination.

1. External supervision, assigning false numbers, and double valuation under camp mode should be introduced. Automatic revaluation of all papers securing above 60% should be adopted. In the case of answer papers that have been valued twice, no request for further revaluation or recounting should be entertained. Marks as received by the entrance commissioner as on last working day of the first week of June of the year should only be considered.

2. Detailed evaluation scheme for both Plus Two and VHSE should be vetted by a committee of Plus Two and VHSE teachers and external experts and be strictly enforced.

3. Examiners for Plus Two and VHSE should not be drawn from the respective streams alone; they should be from both streams in each case. The valuation of both the streams should be done under a common Board of Examiners.

4. Examination centres for plus two and VHSE students should be arranged in schools other than schools where the candidates have studied.

5. Government should introduce technology enabled open exam halls where the examination halls and question/answer paper handling should be web-cast for public scrutiny and for enhancing transparency at least from 2010.

6. The scheme has to be announced urgently for the 2009 examinations.

3. Comparison of marks of applications from different streams (Higher Secondary, CBSE, ICSE)

1. These marks (or grades, converted into point scores) will be subjected to a process of "normalization", following the procedure given by Winters. [*"Score Normalization as a Fair Grading Practice' Winters, R. Scott. ERIC Digest, Report No. EDO-TM-02-1O. Office of Educational Research and Improvement (ED), Washington, D. C.*] (Attached as Annexure B) This will require gathering the basic background data from all the concerned Examination Boards, like the CBSE, ICSE, Kerala HSS and other State Boards.

2. Converting grades into marks: For applicants who have earned their qualifying certificate from Boards under whose evaluation systems Grades and not marks are awarded, for the purposes of normalisation, the mid point of the range of marks represented by each grade would be taken as the value for the purpose of arriving at the determination.

3. The information regarding the marks I grades in the qualifying exams will be available only after those results are out. So the Commissioner for Entrance Examinations will have to wait until this information has been received and tabulated, before publishing the Rank List. Hence it is necessary to fix a deadline for the receipt of these marks. As already mentioned, marks as received by the entrance commissioner on the last working day of the first week of June of the year should only be considered The Commissionerate of Entrance Examination should take steps well in advance to tie up with the Central Board of Secondary Education, New Delhi and the Indian Council of Secondary Education, New Delhi to obtain the database of the results in an electronic format immediately after the announcement of the results of these examinations.

4. **Combining marks of qualifying examination and entrance examination**

   Total marks of the candidate in the entrance examination should be brought to a scale of 0-100 and added to the total of the normalised marks of the three subjects in the qualifying examination, after scaling and conversion to a 0-100 scale.

Both the components should be computed to an accuracy of four decimal places.

5. Future refinements to the process

Once the reforms are in place in 2009, the process of normalization recommended here should be further fine- tuned with the assistance of a group of statisticians based on the experiential understanding derived each year. Data inputs like regional / gender I repeaters / institutions of study / socio-economic background biases in previous years should be taken into account in this process.

2. Distribution of questions and Number of Distracters

The idea of tougher and tougher entrance exams has to give way to exams with graded levels of questions. The paper should contain about 20%-Challenging, 30%- Application-oriented, 50%: Direct Questions.

Each Question should have 4 distracters (one correct response and three incorrect responses).

3. Subject Weightage

For the Engineering Stream, the present weightage for Maths, Physics and Chemistry (5:3:2) should continue. In the case of the Medical stream, equal weightage is to be given for Physics, Chemistry and Biology (1:1:1). The number of questions should be as follows:

Maths — 120
Biology — 120 (Botany 60, Zoology 60)
Physics & Chemistry — 60 each

Physics and Chemistry examinations should be common for the engineering and medicine streams.

The weightages for the Engineering and Medical Streams shall be ensured by scaling the marks with the appropriate set of multiplicative factors.

4. Number of Chances

The number of chances to appear for the Entrance Test for a student should be limited to two for general Candidates and four for Scheduled Caste candidates. The number of chances for Scheduled Tribe candidates should be unlimited.

Such a restriction will contribute to the effectiveness of the Entrance Examination System in identifying students of genuine merit and discourage undue reliance on drill-based training.

5. Question Bank

- It is felt that the process of setting question papers for common entrance examinations needs a complete change to address the issue of subjectivity, confidentiality and efficiency, effectively. It is also felt that a transition to an on-line examination needs to commence now, to realize it in a few years from now. The solution suggested is the creation of a question bank.

- A database containing several thousands of objective type questions in Mathematics, Physics, Chemistry and Biology with graded difficulty levels, from which the software can generate random question papers with desired mix of difficulty gradations, is proposed. The software will have feature to build a database of 'dynamic' questions with numerical values or phrases randomly selected within given constraints, adding to the variety and randomness. There shall also be passage based comprehension questions, with Multiple Choice answers.

Question Bank for each subject should be continually expanded / modified. When the bank has sufficiently large number of questions it could be made available on-line and be made public, so that the candidates shall have free access to it.

- Each subject should be divided into several topics (at micro level) to ensure that the entire syllabus is covered.

- Every question shall have about 5-10 distracters and ONE correct answer. The software will randomly pick 3 from the former and the correct response

- There shall be a minimum of 3000 questions in each subject, which is 25 times the number of questions required each year (120). in addition to this, with the dynamic nature of some questions and 5-10 distracters to choose from, the choice for random selection of questions will, in effect, be much more than 3000.

- The question bank development process requires a large pool of resource persons being identified, with a series of workshops being held under co-ordination of a designated senior officer. There should be a permanent office managed by a senior academic with suitable assistance.

- There shall be a team of 3 Subject Specialists in each subject for discussing, designing, and documenting each question and archiving it using the software. They will be supported by technical persons with adequate computer facility, who will add the questions to the software.

- The Malayalam translation of each question shall also be prepared by the resource persons. When question papers are printed, Malayalam version should appear on the alternate pages of booklets, opposite to the English version.

- Once the Question Bank Division is formed in the Commissionerate of Entrance Examination, applications should be invited for question setters to register with the Division. Questions designed by these question setters alone are accepted as candidate questions.

- The Software should be designed in such a manner that questions along with scanned images of pictures (where necessary) can be entered online by the question setters who have registered with the Question Bank Division for the purpose.

- The Subject Specialists shall also, after detailed deliberations, grade the difficulty of the questions as below average, average and above average. Every question should have identification codes (subject, topic, difficulty level, estimated time taken to answer). The software shall have the facility to fix the mix of the difficulty level in each question paper according to this gradation.

- The Subject Specialists may refer the questions to experts in any subject should they feel that it is necessary to get an expert opinion.

- The question documentation sheet shall be signed off by the Subject Specialists. The workshops will be held under secure facility and all traces of the discussions documents shall be sealed and deposited in a locker.

- After the questions are added to the software, the same shall be printed out and proof-checked by the resource persons themselves, before finally adding the question in the bank, through an appropriate process by the coordinator.

- A Question Bank Division should be set up under the Commissioner of Entrance Examination under a Joint Commissioner. The financial implications for the Question bank project needs to be understood in detail. This project involves significant expenditure. The Committee felt that the value addition it will bring in over the years will more than commensurately compensate this cost. The software for the project could cost 2-5 lakhs. The office set up should have 4 workshop rooms and a co-ordinators room with secure facilities. Each workshop room should have two to three PC and a technical assistant.

- The remuneration for the resource persons would be the biggest cost component. Special rates have to be fixed for resource persons. Even at Rs. 200/question, for 12,000 questions, it will be Rs. 24 lakhs. The first phase of the project could cost around Rs. 50 lakh. With the revenue of close to 7 crore from CEE each year, this is quite justifiable.

- The recommended composition of the Question Bank Division is as follows:

  1. Joint Commissioner of Entrance Examination (Question Bank) – One

  Qualifications: Ph.D in

  Physics/Chemistry/Botany/Zoology or Mathematics with at least 20 years teaching experience at the Higher Secondary Education or College level in Kerala.

  Mode of appointment: Open Recruitment through written test and interview

  Scale of Pay: Equivalent to that of Principal in Government Arts and Science College.

2. Subject Specialists — 15 (three in Physics, Chemistry, Botany, Zoology and Mathematics)

   Minimum Qualifications: (I) Ph.D or (ii) M.Sc and M.Phil in the respective discipline and at least 15 years teaching experience at the Higher Secondary Education or College level.

   Mode of appointment: Open Recruitment through written test and interview

   Scale of Pay: Equivalent to that of Reader/Selection Grade Lecturer in Government Arts and Science College.

3. Systems Manager: One
   Minimum Qualifications: M.C.A/B.Tech (Computer Science) with First Class.

   15 years experience in computer applications (specially in database and web programming)

   Mode of appointment: Open Recruitment through written test and interview or deputation from Government Departments/Colleges.

   Scale of Pay: Equivalent to that of Assistant Executive Engineer in Public Works Department.

4. Systems Analyst: One

   Minimum Qualifications: M.C.A/B.Tech (Computer Science) with First Class.

   10 years experience in computer applications (specially in database and web design)

   Scale of Pay: Equivalent to that of Assistant Engineer in Public Works Department

Mode of appointment: Open Recruitment through written test and interview or deputation from Government Departments/Colleges.

5. Technical Assistants: Four

PGDCA from Universities/ Govt./Quasi Govt. Institutions, with first-class degree in any subject

5 years experience in computer applications (Programming, Database design and Web design)

Scale of Pay: Equivalent to that of Overseer in Public Works Department.

Mode of appointment: Open Recruitment through written test and interview or deputation from Government Departments/ Polytechnic/ Colleges/Quash Govt. Institutions

6. Use of New Technology

1. Intelligent Character Recognition (ICR) technology

ICR technology is now within the reach of institutions and is commercially available at reasonable cost. The Committee recommends that once the Question Banks are in place and public access to students to them is made available, 10-15 % of the questions in ICR mode should be incorporated into the questions. Using ICR technology paper based forms, candidates can enter hand printed text such as names, dates etc. with no special equipment needed other than a pen/pencil. The ICR scanner then processes the forms that are then verified against the database of solutions.

Government should explore the possibility of adopting this technology for the Entrance Examinations.

2. Online Tutorial Services

Once the question banks are thrown open for the use of students, online tutorials attached to the database that will provide access to a self-paced, self- learning tool for all students. Such an innovation will enhance the access of high quality material to students coming from all backgrounds and will further help reduce the income inequality biases that typically creep into entrance examinations.

7. Reservations for Certain Categories

Government have received representations from categories like the National Cadet Corps, Ex Personnel seeking enhancement in the number of seats allotted to them in Professional Engineering Colleges. These representations were referred to this Committee for comments.

The Committee felt that where reservations of for certain categories (Defence Personnel, NCC) are being provided in absolute numbers, it should be increased proportionate to the increase in number of seats in various professional courses. The increase should be worked out separately for seats in Government Engineering Colleges and Self Financing Colleges.

8. Re-organising the Commissionerate of Entrance Examination

The present set up of the Commissionerate is totally inadequate to cater to the changes proposed in the conduct of the pattern of examination.

Sufficient space and staff are essential for such a change in system. There should be a separate building with enough space for data entry and scrutiny, storage of question papers, applications and other materials. Also, the present status of CEE as an appendage of the Higher Education Dept should be discontinued and it should be given an autonomous status.

In addition the separate arrangements recommended above for the Question Bank Division, there should be two wings for the Commissionerate:

A team of Officers should be entrusted with the task of conducting Engineering/Medical Entrance Examinations only. This wing should have:

Joint Commissioner (Academic) - 1

Technical Assistants   -   2

Assistants   -   4

Data Entry Operators   -   2

System Manager   -   1

System Analyst   -   2

System Assistants   -   2

The second wing of the Commissionerate will conduct all the other Entrance Examinations that are being conducted now (13 Nos.). This wing will have:

Joint Commissioner (Academic) - 1

Joint Commissioner (Computer) - 1 (common for Engineering & Medical examinations also)

Technical Assistants   -   4

Assistants   -   3

System Manager   -   1

System Analyst   -   1

System Assistants   -   2

Data Entry Operators   -   2

For both these wings, necessary posts of supporting staff (supervisory staff, clerks and peons) should also be created.

9. Enabling Legislation

The Committee also discussed the possible legal ramifications of the decision to take into account the qualifying marks for admissions to professional course.

The Committee observed that in the case of admission to Architecture courses, a system of combining qualifying marks and the marks in the entrance examination (NATA) is already in vogue.

Furthermore, Tamil Nadu Government have dispensed with the entrance examination in total for admission to professional courses at the undergraduate level.

Government should enact an appropriate enabling legislation for the conduct and regulation of the Common Entrance Examination. This legislation should serve as a robust foundation for the proposed system and the modifications suggested in this report.

10. General

a. To enable students to make informed decision about branch of study, the Entrance Commissioner may produce half hour videos of each branch of professional study and broadcast through visual media and other mass communication channels available. This may be integrated with the scheme "Padavukal" of IT Mission, and also Victors Channel of IT @ School.

b. Establishment of a Scholarship Fund

The Committee discussed at length the equity dimension of the present system of admission to the professional colleges in the State.

While the Committee felt that the proposed reforms would contribute in a big way to create a level playing field for students hailing from diverse economic and social backgrounds, it felt that the field of professional education itself is biased heavily in favour of students hailing from well to do economic backgrounds. The heavy cost associated with professional education often discourages or deters students from poorer economic backgrounds from even considering professional areas of engineering and medicine as a viable career option.

The Committee strongly recommends that Government should institute a Scholarship Fund for supporting needy students to pursue studies in professional colleges. The Committee noted that with reference to the Annual Budget 2008-09, the total expenditure incurred for the conduct of Entrance Examinations was Rs.3.75 cr. in 2007-08. The revenue earned is of the tune of Rs.10 Cr. This means that the State Government earns net annual revenue of Rs. 7 Cr. approximately from the entrance examinations to professional colleges. The Committee recommends that this amount should be used to create a Scholarship Fund. This Fund should be supplemented by contributions from alumni of professional colleges, from Industry both in and outside Kerala and Non Resident Indians. The Fund should be administered by an autonomous, quasi-Government trust with representation from industry groups, eminent educationists, and representatives from professional Engineering/Medical etc. groups besides Government nominees. The Fund should be administered to the highest standards of accountability and transparency.

11. Steps already taken

The following measures have been implemented in 2007 as part of the interim report:

(i) The time of examinations has been extended by half an hour.

(ii) The minimum qualifying marks for the entrance examinations for admission to MBBS and BDS courses have been changed to 50% with relaxation for SC/ST/SEBC.

(iii) The minimum marks prescribed for the Qualifying Examinations, namely, 50% for Mathematics, Physics and Chemistry for engineering applicants, should continue.

ANNEXURE A

ANNEXURE A

<u>Report of the Committee of Expert Statisticians, constituted by Government of Kerala, vide GO(Rt) No. 544/08/H.Edn dated 29.3.2008 to study the normalization procedure appended to the Government order for the purpose of comparison of marks secured at the Plus Two level in various streams (HSC, JCSE,CBSE).</u>

Members of the Committee

1. Prof. P. Yageen Thomas, Professor & Head, Department of Statistics, University of Kerala, Kariavattom, Thiruvananthapuram

2. Dr. P. Sankara Sarma, Additional Professor, Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram

3. Sri. M. Somasekharan Pillai, Lecturer (Senior Grade), Department of Statistics, University College, Thiruvananthapuram

4. Dr. S. Rajoo Krishnan, Department of Statistics, Government College for Women, Thiruvananthapuram

The Committee held two sittings, on 10.4.2008 and 7.5.2008, at the Department of Statistics, University of Kerala. All the four members of the Committee attended the two meetings.

The Committee discussed in detail, the procedure for normalization appended to the government order (Score Normalization as a Fair Grading Practice by R. Scott Winters, University of Pennsylvania).

The Committee was of the opinion that choosing an arbitrary average and standard deviation for the distribution wished to be set as baseline could not be justified in the context of normalization of marks for ranking candidates in a very competitive selection process. The mean and standard deviation to be set for the baseline distribution should be arrived at, meaningfully. Moreover, the underlying distribution of the population has to be Normal if the formula suggested is to be meaningful. The committee also stressed the need of the study by utilizing the data of marks of candidates who had passed from different streams of Examinations at Plus Two level during the past 5 years.

It was also observed that the Higher Secondary Examination of the State of Kerala has moved over to the Grading pattern and that the marks secured by candidates would not be disclosed in the Mark sheet in due course. The system of allotting Grades for different ranges of marks has already been implemented in the state. The committee was of the view that any assumption on marks based on grades would be unfair in a highly competitive selection process. Hence the Committee was of the view that the actual marks should be shown in the Marks Sheet issued to students of the State Higher Secondary scheme to have a meaningful Normalization.

The Committee discussed three different methods used for Normalization in other examinations/selection processes. They were the ones used in (i) Graduate Aptitude Test in Engineering (GATE) (ii) TANCET (Tamil Nadu Common Entrance Test for admission to M Tech and other courses) and (iii) Professional Course Admission in Tamil Nadu.

Of these, the first two methods were developed on the lines suggested in R. Scott Winters with minor modifications. Both these methods consider the mean and standard deviation of marks in each stream. In the third, the marks in different streams were re-calculated by considering the maximum mark awarded in each stream as 100. In this method, the variation in marks in the stream has not been given any consideration.

So the committee after considering the merits and demerits of the different methods, decided to evolve a method, modifying appropriately, the method suggested by *R. Scott Winters.*

Accordingly, the committee put forward the following recommendations.

The Entrance Examination for ranking is conducted by the Government of Kerala. Majority of the candidates appearing at the Entrance Examination comes from the state Higher Secondary Stream. So the Committee was of the opinion that the marks in the State Higher Secondary Stream should be the base group and that the marks in the other streams should be normalized to an equal value of marks with respect to the state Higher Secondary marks pattern.

Again as majority of the candidates taking the Entrance Examination are candidates appearing for the qualifying examination of the current year, the marks of the current year is recommended as the standard. However, there would be quite a number of candidates appearing in a year for the Entrance Examination, with their qualifying examination passed at least one year prior to that. So while suggesting a method of Normalization, this aspect also has to be taken care of.

In short, the issues are two.

   (i) Bringing the marks of previous years in each stream to the current level of that stream

   (ii) Bringing the marks in the different streams of the current year and the converted marks of that scheme in previous years on a comparable level to that of the state Higher Secondary Stream.

The following notations are used for representing various factors.

Let 'P' denote 'Previous Year' and 'C', the 'Current Year'.

Let 'H' represent the Higher Secondary Stream of Kerala and 'O' represent any 'Other' Stream.

Let 'X' denote the original Mark and 'Y', the Normalized mark.

So X_P will be the mark in a subject obtained by a candidate of any stream in a Previous Year. This has to be scaled to the current year level of that stream initially (say Y_c) by the formula (for scientific support see Winters (2002)),

$$Yc \ = \ \mu c \ + \ \sigma c \left(\frac{Xp \ - \ \mu p}{\sigma p} \right),$$

where μ_p and σ_p respectively denote the mean and standard deviation of marks of that stream for the concerned previous year and μ_C and σ_C are the mean and standard deviation of marks of that stream for the current year.

Once this is done, the marks for the previous years are transformed to the level of marks of the current year.

Now we pool the marks of Higher Secondary stream (current year and converted marks of candidates who appeared in previous years) and obtain their mean μ_H and standard deviation (SD) σ_H . Similarly we pool the marks of current year with the equivalent marks of those appeared in previous years of each of the 'Other system' and obtain their mean μ_O and SD σ_O . Now the marks of the candidates in the other stream (say Xo) have to be scaled to the equivalent level (say Y_H) of the State Higher Secondary marks, by using the formula,

$$Y_H \ = \ \mu_H \ + \ \sigma_H \left(\frac{Xo \ - \ \mu o}{\sigma o} \right),$$

If the maximum marks for a subject are not identical in different streams, they may first be brought to a common level (say out of 100), before normalizing.

The above process is to be done subject wise as required.

Limitations: The above method works very well statistically, if the population follows Normal or approximately Normal distribution. If this condition is violated, the method may bring slight variations. However, the standardization, as described above is meaningful since the Normalization is done by considering the variability in the data of a stream and incorporating the same into the formula.

For effective implementation of the above proposal, the data of marks of all candidates who have passed the examination in the Current year or at least their mean and standard deviation are essential. Identical information relating to previous years will be needed as per requirement.

The Committee is of the strong opinion that presentation of scores through Grades alone will not be useful in providing Normalized marks to be incorporated for ranking

candidates for admission to Professional Degree Courses. The actual marks obtained by candidates should be made available.

Depending on the mean and standard deviation, there is a possibility of the Normalized scores in other streams exceeding 100. (Assuming that initially all the marks are out of 100). This may not cause any problem since such values are used only for ranking purposes.

An Illustration is appended.

ILLUSTRATION

Stage I							
Year Normalisation (Let the mean of a subject in 2004 be 57.6 and SD 11.8							
Let the mean mark of the same subject in 2008 be 65.8 and SD 12.45							
The marks obtained for 5 students in the same subject in 2004 are given							
2004	Z Score	Normalised to 2008					
51	-0.5593	58.8364					
87	2.4915	96.8195					
64	0.5424	72.5525					
73	1.3051	82.0483					
93	3.0000	103.1500					
Stage 2							
An example for Normalisation of marks of current Year							
	CBSE	ISC	HSC-Kerala	Standardised CBSE	Standardised ISC	Normalised CBSE	Normalised ISC
	65	82	61	-0.1163	1.5545	63.1959	93.4171
	78	68	38	0.6398	0.5786	76.8727	75.7651
	49	69	46	-1.0470	0.6483	46.3629	77.0260
	82	58	91	0.8725	-0.1185	81.0809	63.1565
	38	67	95	-1.6868	0.5089	34.7903	74.5043
	51	41	65	-0.9307	-1.3036	48.4671	41.7220
	59	38	58	-0.4653	-1.5127	56.8835	37.9394
	90	70	59	1.3378	0.7180	89.4974	78.2868
	77	59	62	0.5817	-0.0488	75.8206	64.4174
	81	45	78	0.8143	-1.0247	80.0288	46.7654
Mean *	67	59.7	65.3				
SD *	17.192	14.345	18.087				
* Mean and SD to be arrived at by considering the transformed marks of previous years in that stream also							

ANNEXURE B

Score Normalization as a Fair Grading Practice

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Course instructors want to evaluate students in a manner that is fair and based upon the student's representative performance. Discussions of fair grading practice tend to focus on: grading methodology and individual assignments (i.e., Glean, 1998), the determination of an appropriate metric and clearly articulating expectations to students (i.e., Davis, 1993). Few guidelines address practical considerations for integrating multiple assignments (e.g., determining final grades based upon multiple exams written by different instructors) and the prerequisite statistical methodologies (but see Cross, 1995). This Digest outlines an appropriate means to handle these situations in a fair and equitable manner. Included is a detailed example, based upon real class data, which illustrates the disparity in grade assignment with and without proper normalization.

All Scores Are Not Equal

While fair grading is easily understood when discussing a single assignment (such as an exam or paper) it becomes a more difficult issue when multiple assignments are considered. For instance, if a student gets a 50 on an exam that is very hard (hence the 50 is the highest grade among all students), and a 60 on a second exam that is very easy (hence the lowest grade among all students), are these exams equitable? If a student is given the option of dropping the "lowest grade" of the two, does it make sense to drop the exam that, a) reflects the lowest numerical score (the 50), or b) reflects poorer performance (the 60)?

If we set our evaluation criterion as a performance measure, then the score reflecting poor performance should be dropped. However, in order to make such an evaluation, the exams need to be converted into a common currency; specifically, they need to be placed upon a standard scale for comparison. Therefore, using raw scores to calculate final grades may not accurately capture a student's true performance within a class. As

variation in performance evaluation increases, so does the impact on the student's final ranking.

Ideally, we would like the distribution of individual student performance for all exams to be equal, despite differences in time, instructor, teaching assistant, and other factors. Only then can evaluations be considered comparable. Without this common currency or scale, errors in grade assignment will result. Fortunately, the methodology for placing diverse assignments on an equitable scale is straightforward. Appropriate normalization requires nothing more than adjusting the exams' means to be equal as well as their variances. If different teaching assistants instruct different subsets of the class, then these subsets also need to be standardized for equal means and variances across teaching assistants.

The need for normalization is intuitive to most: an exam with a mean of 4O is not equitable to an exam with a mean of 70. The obvious correction is to readjust the scores such that the means are equal; this is a good first step, but alone, it is insufficient. Equally important is the need to correct for differences in the variances. A template for making such calculations is introduced below.

The Normalization Process

We begin by converting an individual score into a context-free evaluation of relative performance. Next, we will transpose this context-free evaluation into a performance measure (a normalized score) based upon a distribution that we define (that is, we will dictate what the mean and variance are to be). In this manner, scores from different evaluations (exams, instructors, laboratory sections, etc.) can be transposed onto a common scale. When all of the course's evaluations are based upon the same distribution, they can reasonably be compared.

The context-free evaluation we will work with is a z-score. A z-score captures an individual performance relative to the population's mean and variance.

$$z = (X-M)/S$$

where: z refers to the z-score, M is the estimate of the population's mean, S is the estimate of the population's standard deviation, and X is an individual score within the distribution having mean M and variance S.

Since z-scores give us a relative performance measure, then the same z-score can be derived from significantly different distributions. Thus, any score from one distribution can be converted into a score for a second distribution, while maintaining that same relative performance (the same z-score).

For any assignment in a class, we know the absolute score for every student and can estimate the mean and the standard deviation for that assignment based upon all students' scores. Therefore, we can convert each student's absolute score into a z-score. With z-score in hand, we can calculate a new absolute score for any distribution we define. That is, we can declare a mean and standard deviation we wish the new distribution to have and then solve for the absolute numerical value that the z-score would take. This is called the T score or transformation score.

$T = m+(s)(z)$

where: T refers to the transformed score on the new distribution, m is the target mean, s is the target standard deviation, and z is the z score.

Working through an example—one student

Let us take a specific example of one student's performance on three separate exams where we intend to drop the "lowest" exam score. The vernacular of "lowest exam score" is misleading since our true intention is to drop the grade representing the student's worst performance on any of the three exams. Table I gives the student's grades along with the average and standard deviation for the performance of all students on each exam.

Table I			
	Exam I	Exam 2	Exam 3
Student's Performance	69	75	72
Class Average	58	66	62
Class Standard Deviation	22	19	9

Normalization begins by choosing an arbitrary average and standard deviation for the distribution we wish to set as our baseline. In this example, an average of 70 and a standard deviation of 15 are selected. In order to normalize the student's performance on exam 1, we simply fill in those values that we have. Thus, for Exam I, the student's z-score is

$$z=(69-58)/22=.5$$

and

$$T=70+(15)(.5)=77.5$$

While the numerical value may have changed, the student's relative performance (the z-score) has not. A grade of 77.5 within a distribution having an average of 70 and standard deviation of 15 represents the same relative performance as a grade of 69 within a distribution having an average of 58 and a standard deviation of 22.

If we were normalizing the grades of an entire class, then we would use the same equation and change the values for the original grades for each student in order to obtain each student's normalized grade (T-score). Performing similar calculations for Exam 2 and Exam 3 generates normalized scores of 77.1 and 86.67, respectively. Therefore, Exam 2 should be dropped since the student's performance is the lowest.

Working through an example—an entire class

This example illustrates how final scores for individual students can change dramatically depending on whether normalization procedures are adopted.

The example is derived from real data for an introductory biology course taught at a large university and is based upon scores for 205 students. For each student, there are five grades: three exams, a final, and a laboratory score. It is the policy of the department that grades be calculated according to the following criteria:

A. the "lowest" of the three exam scores is to be dropped,

B. each of the two remaining exams is worth the same as the final, and

C. the laboratory score is worth one and one half times any exam (which represents one third of the course evaluation). Complicating the matter is the fact that students are pseudo-randomly assigned to one of seven laboratory instructors. Laboratory instructors vary tremendously in their knowledge, experience, and difficulty. Finally, two instructors co-lectured the course and exams were written independently (with the exception of the final).

For simplicity, let us assume that grades are based upon the following schema: the top 5% will receive an A+, the next 5% an A, the next 15% a B, the next 50% a C, the next 15% a D, and the last 10% an F. In reality, a far more complicated method is— and should be - used that bases an individual's grade on an absolute score rather than a relative measure such as intra-class competition.

Differences in grade assignment between pre-normalization (raw) and post-normalization are profound. Approximately 27% of the class (56 out of 205 students) would have been assigned the wrong grade had the instructors not normalized the scores. In fact, the grades for 52 students changed by one letter grade, and 4 students changed by two letter grades. Looking at one superficial aspect of these dynamics, we note that 37% of students have a different exam score dropped post-normalization. The effects of such changes influence the top, more competitive, tiers. Without normalization, 40% of A+ grades are incorrectly assigned and the ranking of the top three students is incorrect. In fact the student who performed the best in class would have been wrongly assigned a B without normalization. More dramatically, prior to normalization, another student would have incorrectly been considered average, C, when in fact their work merited an A relative to his or her peers.

Acknowledgements

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