Report of the Committee of Statisticians, constituted by Kerala Public Service Commission, to study the standardization procedure for Degree Level Common Preliminary Examinations, 2023.

The Kerala Public service Commission constituted the committee to standardize the marks obtained by candidates in preliminary examinations to short list candidates who secured marks above a cut off mark for the selection to the main examination. The preliminary examinations conducted on three different dates with different question papers based on the same syllabus.

One cannot determine which question is more difficult simply by reading the questions. It is not fair to decide a question is more difficult based on intuition or subjectivity of a person. The decision can be taken only based on empirical evidence.

So, the committee decided to compute the index of difficulty (difficulty level) of each question in each question paper. **The index of difficulty (p) of a question is defined as the proportion of correct answers of that question (that is the number of correct answers of the question divided by the total number of candidates who wrote the examination with the respective question paper) (Nitko (1996), Crocker & Algina, 1986).** The larger the proportion getting a question right, the easier the question. The higher the difficulty index indicates the easier the question and the lower the index of difficulty indicates the question is difficult. The index of difficulty will be always in between 0 and 1. **The index of difficulty '0' means the maximum is the difficulty and '1' means the difficulty is minimum.** The committee carried out an exploratory analysis on the marks of three phases. Based on the analysis, the performances of the top ten percent of the candidates of each phase are taken into the computation of the difficulty indices. In each question paper, the difficulty index of all questions are computed and classified into ten categories based on the number of correct answers of each question.

The questions in each question papers are to be divided into ten strata as follows:

Stratum No.	Range of difficulty index(p)
1	$0 \leq p \leq 0.1$
2	$0.1 < p \leq 0.2$
3	$0.2 < p \leq 0.3$
4	$0.3 < p \leq 0.4$
5	$0.4 < p \leq 0.5$
6	$0.5 < p \leq 0.6$
7	$0.6 < p \leq 0.7$
8	$0.7 < p \leq 0.8$
9	$0.8 < p \leq 0.9$
10	$0.9 < p \leq 1.0$

The Committee considered different procedures for standardization and illustrated with sample data. The Committee was of the opinion that the effect of standardization should be same for all candidates who scored the same mark within a particular group (answered a particular question paper) because the weightage of all questions were same while conducting the examination. Also it is not fair to give the same benefits of difficulty for all in a phase because the difficulty level of candidates within a phase may be different due to various reasons. So, the committee decided to give the benefits of difficulty proportional to the performance of the candidates. The committee unanimously suggests the following procedure for standardization.

All questions in a question paper are to be stratified into ten levels as given above. Then a score of difficulty (DS) is to be computed for each question paper as given below.

Compute $DS_i = \sum[N_{ij} \times (1-M_j)] / N_i$

Where DS_i is the score of difficulty for the ith question paper; N_{ij} is the number of questions in the jth stratum of the ith question paper, $(1-M_j)$ is the median difficulty level of the jth stratum ($M_1=0.05$, $M_2=0.15$, $M_3=0.25$, $M_4=0.35$, $M_5=0.45$, $M_6=0.55$, $M_7=0.65$, $M_8=0.75$, $M_9=0.85$, $M_{10}=0.95$), N_i is the number of correct questions in the ith question paper.

Then the proportion of difficulty (PD) of each question paper to the lowest difficult question paper (DS_i is minimum) can be computed as:

$$PD_i = (DS_i/ DS_{min})$$

PD_i is the proportion of difficulty of the ith question paper to the lowest difficult question paper; DS_{min} is the score of difficulty of the question paper which has the minimum DS.

Then the final mark of the jth candidate who attended the ith question paper (S_{ij}) is to be computed as:

$$S_{ij} = Min[100, M_{ij} \times PD_i]$$

Where M_{ij} is the mark actually scored **out of 100** (including negative marks) by the jth candidate in the ith group.

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Note:

1. All the marks may be corrected to a convenient number of decimal places to break tie.

2. The standardization procedure depends on the nature of data, hence the above said procedure cannot be applied to another situation without exploring the feasibility of the method.

References

1. Crocker L. and Algina J. (1986). Introduction to classical and modern test theory, New York: Holt, Rinehart and Winston.

2. Nitko A.J (1996): Educational assessment of students. Second edition, New Jersey, USA, Prentice- Hall.

Table 1

Strata	N_{ij}		
	Phase I	Phase II	Phase III
S1(0 - .1)	5	11	10
S2(.1 - .2)	10	13	9
S3(.2 - .3)	6	10	4
S4(.3 - .4)	8	10	5
S5(.4 - .5)	6	11	3
S6(.5 - .6)	6	6	7
S7(.6 - .7)	6	12	10
S8(.7 - .8)	10	10	11
S9(.8 - .9)	19	7	17
S10(.9 -1)	20	5	23
Total	**96**	**95**	**99**

Table 2

Phase	Score of Difficulty (DS)	Proportion of Difficulty (PD)
I	0.38958	1.0110
II	0.55	1.4273
III	0.38535	1.0

Table 3:

Method of calculating actual marks from the marks awarded after standardisation.

Actual marks scored (i.e.,before standardisation) = $\dfrac{\text{Marks awarded after standardisation}}{\text{Proportion of Difficulty (as in \textbf{Table 2})}}$

Example:

Phase	Marks awarded after standardisation	Actual marks scored (i.e.,before standardisation)
I	51.00	(51.00/1.011) = 50.45
II	51.00	(51.00/1.4273) = 35.73
III	51.00	(51.00/1) = 51.00
I	60.00	(60.00/1.011) = 59.35
II	60.00	(60.00/1.4273) = 42.04
III	60.00	(60.00/1) = 60.00