Document on Normalization

MHTCET will be conducting examinations on multiple shifts. The candidates will be given different sets of questions in every shift and it is quite possible that in spite of all efforts of maintaining equivalence among various question papers, the difficulty level of these question papers administered in different shifts may not be exactly the same. In order to overcome such a situation, **Normalization Method** will be used for ensuring that candidates are neither benefitted nor disadvantaged due to the difficulty level of the examination.

The process of Normalization is an established practice for comparing candidate scores across multi shift papers and is similar to those being adopted in other large educational selection tests conducted in India.

Percentile Scores: Percentile scores are scores based on the relative performance of all those who appear for the examination. Basically the marks obtained are transformed into a scale ranging from 100 to 0 for each session of examinees.

The Percentile Score indicates the percentage of candidates that have scored EQUAL TO OR BELOW (same or lower raw scores) **that particular Percentile in that examination. There fore the topper (highest score) of each session will get the same Percentile of 100 which is desirable. The marks obtained in between the highest and lowest scores are also converted to appropriate Percentiles.**

The Percentile score will be the Normalized Score for the examination (instead of the raw marks of the candidate)**.**

The Percentile Scores will be calculated up to 7 decimal places to avoid bunching effect and reduce ties.

The Percentile score of a Candidate is calculated as follows:

$$\frac{100 * (No.of\ candiddates\ appeared\ in\ the\ session\ with\ raw\ score \leq\ the\ candidate's\ Score)}{\text{Total no.of candidates in the session}}$$

Note: The Percentile of the Total shall NOT be an aggregate or average of the Percentile of individual subject. Percentile score is not the same as percentage of marks obtained.

Example: Suppose a test was held in 4 sessions of examinees as per details given below: - (Allocation of Days and shifts were done randomly)

(a) Distribution of candidates were as follows:

Session-1: Day-1 Shift-1, Session-2: Day-1 Shift-2, Session-3: Day-2 Shift-1 and Session-4: Day-2 Shift-2

Session	Day/ Shift	No of candidates			Marks	
		Absent	Appeared	Total	Highest	Lowest
1	Day-1 Shift-1	2516	28065	30581	191	1
2	Day-1 Shift-2	2312	27974	30286	194	3
3	Day-2 Shift-1	2278	27783	30061	195	4
4	Day-2 Shift-2	2048	27378	29426	193	3
Total		9154	111200	120354	195	1

In this method of scoring, the HIGHEST RAW SCORE in each paper (irrespective of the raw scores) will be the 100 Percentile indicating that 100% of candidates have scores equal to or lesser than the highest scorer/ topper for that session.

Highest Raw Score and Percentile Score: All the highest raw scores will have normalized Percentile Score of 100 for their respective session.

Session	Total candidates appeared	Highest Raw Score	Candidates who scored EQUAL OR LESS THAN Highest Raw Score	Percentile Score	Remarks
1	28065	191	28065	100.0000000 [(28065/28065)*100]	i.e. all the highest raw scores would be normalized to 100 Percentile Score for their respective session.
2	27974	194	27974	100.0000000 [(27974/27974)*100]	
3	27783	195	27783	100.0000000 [(27783/27783)*100]	
4	27378	193	27378	100.0000000 [(27378/27378)*100]	

<u>Lowest Raw Score and Percentile Score:</u> Percentile Score of all the lowest raw scores will depend on the total number of candidates who have taken the examination for their respective session.

Session	Total candidates appeared	Lowest Raw Score	Candidates who scored EQUAL OR LESS THAN Lowest Raw Score	Percentile Score	Remarks
1	**28065**	**1**	**1**	**(1/28065) [(1/28065)*100]**	i.e. Percentile Score of **all the lowest raw scores are different** i.e. Percentile Score depend on the total number of candidates who have taken the examination for their respective session.
2	**27974**	**3**	**1**	**(1/27974) [(1/27974)*100]**	
3	**27783**	**4**	**1**	**(1/27783) [(1/27783)*100]**	
4	**27378**	**3**	**1**	**(1/27378) [(1/27378)*100]**	

STEP-BY-STEP PROCEDURE FOR NORMALIZATION AND PREPARATION OF PERCENTILE SCORE:

Step-1: Distribution of Examinees in two days and in two shifts per day Candidates would be distributed into four sessions randomly so that each session has approximately equal number of candidates. These four sessions would be as follows:

Session-1: Day-1 Shift-1, **Session-2:** Day-1 Shift-2, **Session-3:** Day-2 Shift-1 and **Session-4:** Day-2 Shift-2

In the event of more number of days or more number of shifts, the candidates will be divided accordingly.
This will ensure that there is no bias in the distribution of candidates who shall take the examination. Further, with a large population of examinees spread over the entire country the possibility of such bias becomes remote.

Step-2: Preparation of Results for each Session: The examination results for **each session** would be prepared in the form of

- Raw Scores
- Percentiles Scores separately for each of the three subjects (Mathematics, Physics, Chemistry) and the Total.

The following 4 Percentiles would be calculated for each candidate in the Session: Let T1,M1, P1, C1be the raw scores in Total, Mathematics, Physics, Chemistry of a candidate and T1P, M1P, P1P, C1Pbe the Percentile Scores of Total, Mathematics, Physics, Chemistry of that candidate.

$$\text{Total Percentile (T1P)} = 100 \text{ X } \frac{\text{No.of candidates appeared from the session with raw score equal to or less than T1 score}}{\text{Total no of candidates appeared in the session}}$$

$$\text{Mathematics Percentile (M1P)} = 100 \text{ X } \frac{\text{No.of candidates appeared from the session with raw score equal to or less than M1 score in Mathematics}}{\text{Total no of candidates appeared in the session}}$$

$$\text{Physics Percentile (P1P)} = 100 \text{ X } \frac{\text{No.of candidates appeared from the session with raw score equal to or less than P1 score in Physics}}{\text{Total no of candidates appeared in the session}}$$

$$\text{Chemistry Percentile (C1P)} = 100 \text{ X } \frac{\text{No.of candidates appeared from the session with raw score equal to or less than C1 score in Chemistry}}{\text{Total no of candidates appeared in the session}}$$

Step-3: Compilation of Total CET score:

The Percentile scores for the Total Raw Score for all the four sessions (**Session-1:** Day-1 Shift-1, **Session-2:** Day-1 Shift-2, **Session-3:** Day-2 Shift-1 and **Session-4:** Day-2 Shift-2) as calculated in Step-2 above would be merged and shall be called the CET scores which will then be used for compilation of result.

The Percentile of all four sessions will be calculated separately for the Total raw score and the raw scores in three subjects (Mathematics, Physics, and Chemistry) as follows:

PERCENTILE : SESSION-1 i.e. DAY-1 SHIFT-1

Roll No.	Physics		Chemistry		Mathematics		PCM Total	
	Raw Score	Percentile	Raw Score	Percentile	Raw Score	Percentile	Raw Score	Percentile
D1S1 - 01	47	99.9786211	46	100	98	99.9750579	191	100
D1S1 - 02	48	100	43	99.9287369	100	100	191	100
D1S1 - 03	46	99.9608053	46	100	98	99.9750579	190	99.9928737
D1S1 - 04	45	99.9287369	46	100	96	99.8610369	187	99.9893105
D1S1 - 05	45	99.9287369	45	99.9857474	96	99.8610369	186	99.9857474
D1S1 - 06	48	100	41	99.8325316	96	99.8610369	185	99.9821842
D1S1 - 07	48	100	37	99.3336896	100	100	185	99.9821842
D1S1 - 08	43	99.7078211	45	99.9857474	96	99.8610369	184	99.9750579
↓	↓	↓	↓	↓	↓	↓	↓	↓
↓	↓	↓	↓	↓	↓	↓	↓	↓
D1S1 - 28064	1	0.0997684	0	0.4240157	0	0.0356316	1	0.0285053
D1S1 - 28065	1	0.0997684	0	0.4240157	0	0.0356316	1	0.0285053

PERCENTILE : SESSION-2 i.e. DAY-1 SHIFT-2

Roll No.	Physics		Chemistry		Mathematics		PCM Total	
	Raw Score	Percentile	Raw Score	Percentile	Raw Score	Percentile	Raw Score	Percentile
D1S2 - 01	46	99.8820333	50	100	98	99.9034818	194	100
D1S2 - 02	46	99.8820333	49	99.9964253	98	99.9034818	193	99.9964253
D1S2 - 03	47	99.9356545	48	99.9892758	98	99.9034818	193	99.9964253
D1S2 - 04	48	99.9749768	47	99.971402	98	99.9034818	193	99.9964253
D1S2 - 05	49	100	44	99.7855151	100	100	193	99.9964253
D1S2 - 06	46	99.8820333	48	99.9892758	98	99.9034818	192	99.9821263
D1S2 - 07	49	100	47	99.971402	96	99.7068707	192	99.9821263
D1S2 - 08	47	99.9356545	47	99.971402	98	99.9034818	192	99.9821263
↓	↓	↓	↓	↓	↓	↓	↓	↓
↓	↓	↓	↓	↓	↓	↓	↓	↓
D1S2 - 27973	0	0.1072424	1	0.3789233	2	0.0500465	3	0.0393222
D1S2 - 27974	0	0.1072424	1	0.3789233	2	0.0500465	3	0.0393222

PERCENTILE : SESSION-3 i.e. DAY-2 SHIFT-1

Roll No.	Physics		Chemistry		Mathematics		PCM Total	
	Raw Score	Percentile	Raw Score	Percentile	Raw Score	Percentile	Raw Score	Percentile
D2S1 - 01	49	99.9928014	48	99.9856027	98	99.9748047	195	100
D2S1 - 02	48	99.9820034	48	99.9856027	98	99.9748047	194	99.9964007
D2S1 - 03	50	100	46	99.8992189	98	99.9748047	194	99.9964007
D2S1 - 04	48	99.9820034	46	99.8992189	100	100	194	99.9964007
D2S1 - 05	50	100	44	99.6220711	100	100	194	99.9964007
D2S1 - 06	48	99.9820034	47	99.9568081	98	99.9748047	193	99.9820034
D2S1 - 07	48	99.9820034	47	99.9568081	98	99.9748047	193	99.9820034
D2S1 - 08	47	99.9460102	46	99.8992189	100	100	193	99.9820034
↓	↓	↓	↓	↓	↓	↓	↓	↓
↓	↓	↓	↓	↓	↓	↓	↓	↓
D2S1 - 27782	1	0.0827844	1	0.345535	2	0.0323939	4	0.0251953
D2S1 - 27783	1	0.0827844	1	0.345535	2	0.0323939	4	0.0251953

PERCENTILE : SESSION-4 i.e. DAY-2 SHIFT-2

Roll No.	Physics		Chemistry		Mathematics		PCM Total	
	Raw Score	Percentile	Raw Score	Percentile	Raw Score	Percentile	Raw Score	Percentile
D2S2 - 01	49	100	44	99.9013807	100	100	193	100
D2S2 - 02	47	99.974432	46	99.9963474	98	99.9488641	191	99.9963474
D2S2 - 03	48	99.9890423	45	99.9707795	98	99.9488641	191	99.9963474
D2S2 - 04	43	99.620133	46	99.9963474	100	100	189	99.9890423
D2S2 - 05	45	99.8721601	44	99.9013807	100	100	189	99.9890423
D2S2 - 06	48	99.9890423	43	99.8283293	98	99.9488641	189	99.9890423
D2S2 - 07	49	100	42	99.72971	98	99.9488641	189	99.9890423
D2S2 - 08	45	99.8721601	47	100	96	99.8064139	188	99.974432
↓	↓	↓	↓	↓	↓	↓	↓	↓
↓	↓	↓	↓	↓	↓	↓	↓	↓
D2S2 - 27377	1	0.1022719	0	0.3031631	2	0.0401782	3	0.025568
D2S2 - 27378	1	0.1022719	0	0.3031631	2	0.0401782	3	0.025568

Merge the Percentile Scores calculated above of all four sessions for the **Total Percentile, Mathematics Percentile, Physics Percentile and Chemistry Percentile** for preparation of CET scores.

PERCENTILE : ALL FOUR SESSIONS COMBINED								
Roll No.	**Physics**		**Chemistry**		**Mathematics**		**PCM Total**	
	Raw Score	**Percentile**	**Raw Score**	**Percentile**	**Raw Score**	**Percentile**	**Raw Score**	**Percentile**
D1S1 - 01	47	99.9786211	46	100	98	99.9750579	191	100
D1S1 - 02	48	100	43	99.9287369	100	100	191	100
D1S2 - 01	46	99.8820333	50	100	98	99.9034818	194	100
D2S1 - 01	49	99.9928014	48	99.9856027	98	99.9748047	195	100
D2S2 - 01	49	100	44	99.9013807	100	100	193	100
D1S2 - 02	46	99.8820333	49	99.9964253	98	99.9034818	193	99.9964253
D1S2 - 03	47	99.9356545	48	99.9892758	98	99.9034818	193	99.9964253
D1S2 - 04	48	99.9749768	47	99.971402	98	99.9034818	193	99.9964253
D1S2 - 05	49	100	44	99.7855151	100	100	193	99.9964253
D2S1 - 02	48	99.9820034	48	99.9856027	98	99.9748047	194	99.9964007
D2S1 - 03	50	100	46	99.8992189	98	99.9748047	194	99.9964007
D2S1 - 04	48	99.9820034	46	99.8992189	100	100	194	99.9964007
D2S1 - 05	50	100	44	99.6220711	100	100	194	99.9964007
D2S2 - 02	47	99.974432	46	99.9963474	98	99.9488641	191	99.9963474
D2S2 - 03	48	99.9890423	45	99.9707795	98	99.9488641	191	99.9963474
D1S1 - 03	46	99.9608053	46	100	98	99.9750579	190	99.9928737
D1S1 - 04	45	99.9287369	46	100	96	99.8610369	187	99.9893105
D2S2 - 04	43	99.620133	46	99.9963474	100	100	189	99.9890423
D2S2 - 05	45	99.8721601	44	99.9013807	100	100	189	99.9890423
D2S2 - 06	48	99.9890423	43	99.8283293	98	99.9488641	189	99.9890423
D2S2 - 07	49	100	42	99.72971	98	99.9488641	189	99.9890423
D1S1 - 05	45	99.9287369	45	99.9857474	96	99.8610369	186	99.9857474
D1S1 - 06	48	100	41	99.8325316	96	99.8610369	185	99.9821842
D1S1 - 07	48	100	37	99.3336896	100	100	185	99.9821842
D1S2 - 06	46	99.8820333	48	99.9892758	98	99.9034818	192	99.9821263
D1S2 - 07	49	100	47	99.971402	96	99.7068707	192	99.9821263
D1S2 - 08	47	99.9356545	47	99.971402	98	99.9034818	192	99.9821263
D2S1 - 06	48	99.9820034	47	99.9568081	98	99.9748047	193	99.9820034
D2S1 - 07	48	99.9820034	47	99.9568081	98	99.9748047	193	99.9820034
D2S1 - 08	47	99.9460102	46	99.8992189	100	100	193	99.9820034
D1S1 - 08	43	99.7078211	45	99.9857474	96	99.8610369	184	99.9750579
D2S2 - 08	45	99.8721601	47	100	96	99.8064139	188	99.974432
D1S2 - 27973	0	0.1072424	1	0.3789233	2	0.0500465	3	0.0393222
D1S2 - 27974	0	0.1072424	1	0.3789233	2	0.0500465	3	0.0393222
D1S1 - 28064	1	0.0997684	0	0.4240157	0	0.0356316	1	0.0285053
D1S1 - 28065	1	0.0997684	0	0.4240157	0	0.0356316	1	0.0285053
D2S2 - 27377	1	0.1022719	0	0.3031631	2	0.0401782	3	0.025568
D2S2 - 27378	1	0.1022719	0	0.3031631	2	0.0401782	3	0.025568
D2S1 - 27782	1	0.0827844	1	0.345535	2	0.0323939	4	0.0251953
D2S1 - 27783	1	0.0827844	1	0.345535	2	0.0323939	4	0.0251953

Similar to this, the same will be calculated for Biology and overall for PCB.

NOTE: The roll numbers provided in the table are only for representational purpose.