

Ministry Category : **Ministry of HRD**Problem Code : **#CBS5**Problem Statement : **Standardization of Marks**Current AICTE Application No: **1-3321509102**Team Leader Name : **Saransh Dave**

IDEA

As per the given problem statement, at present the standardization is leading to:

1. Bunching of marks at certain level
2. The high scorers are at disadvantageous position

The above issues can be solved by using a grading system which follows the given algorithm.

Algorithm

For each subject :-

1. Enter the records (e.g. Rows of an MS-Excel sheet) as per percentage marks of all students in top-down order.
2. Sort the records according to tie-breaking rules (See next slide) to provide a unique rank to each student.
3. Find the percentile score of each student :-

$$\text{Percentile Score} = \frac{\text{Total No. of Students} - (\text{Rank} - 1)}{\text{Total No. of Students}} \times 100\%$$

4. Calculate FP = Highest percentile score among the students who has failed.
5. Calculate percentage of pass students (PP) = 100 – FP
6. Make seven equal groups of pass students corresponding to grades A1, A2, B1, B2, C1, C2, and D from highest to lowest group. Each group will be of size PP/7 percent.
7. Percentage of fail students = FP. Make three equal groups of failed students corresponding to grades F1, F2 and F3 from highest to lowest group. Each group will be of size FP/3 percent.

After the above steps have been applied for all subjects :-

1. Perform upgradation of failures as per upgradation rules (See next slide).
2. Calculate CGPA of all students by taking average of corresponding grade points of all subjects (No CGPA is provided in case a student is failed even after upgradation).

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Grade	A1	A2	B1	B2	C1	C2	D	F1	F2	F3
Corresponding Grade Point	10.00	9.00	8.00	7.00	6.00	5.00	4.00	3.00	2.00	1.00

Tie breaking rules :-

It is possible that two or more candidates have same marks in one or more subjects. Then we use the following priority order for tie-breaking till all students get a unique rank :-

1. Score of Mathematics: The one who has higher score in Mathematics will be given higher rank.
2. Score of Physics: The one who has higher score in Physics will be given higher rank.
3. Score in Chemistry: The one who has higher score in Chemistry will be given higher rank.
4. Date of Birth: One who is younger than others will be given higher rank.
5. Surname: Ranking will be done according to Lexicographical order of surnames.

Upgradation rules :-

Rules for grade upgradation are as follows :-

1. Upgradation rules are applicable if and only if a candidate is fail in only one subject excluding Physics, Chemistry and Mathematics (For Science Stream).
2. A candidate is considered fail if he gets an F grade in 2 or more subjects or an F grade in Physics, Chemistry or Mathematics.
3. If a candidate performs extraordinarily and secures one or more A1 grades in subjects Physics, Chemistry and Mathematics, then he will be given proportionate number of grade upgradations (= number of subjects from PCM with A1 grade) until he makes it to D grade (i.e. at max a candidate can get 3 grade upgradations i.e. if he/she gets an A1 grade in all three subjects of PCM).
4. A candidate is considered fail if he doesn't get a D grade even after upgradation.

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Advantages :-

1. As percentage of passing and failing students are equally divided for grading, the bunching of marks is completely avoided.
2. Range size (i.e. $PP/7$) is proportional to the percentage of passed students, so if the percentage of passing students is more, number of students per passing grade is also more and therefore students get appropriate deserving grades.
3. In this grading system, the students performing extraordinarily in PCM (for Science Stream) get a chance of grade upgradation for the subject in which they are fail.

Limitations :-

1. The final result is in the form of CGPA which creates a problem as there may be many students with same CGPA.
2. Tie breaking is an issue as it may create a problem for students having percentage equal to the percentages corresponding to the grade-wise divisions of percentiles. Also, in some cases tie-breaking is done depending on unreliable parameters like Date of Birth and Surname.

TECHNOLOGY STACK

As we have simply designed a generalized algorithm for data processing, we can use any technology (C++, Java, VBA, etc.) and implement our algorithm using it.

We will be using Visual Basic Applications with MS-Excel for our purpose of implementing the algorithm and presenting the data.

SAMPLE CASE

Let us consider the given database of marks for subject Mathematics for 100 students. The considered database has already been sorted according to tie-breaking rules and a unique percentile has been given to all students.

Rank	% Marks	Persentile	Rank	% Marks	Persentile	Rank	% Marks	Persentile	Rank	% Marks	Persentile
1	100	100	26	84.5	75	51	69	50	76	49	25
2	100	99	27	84	74	52	69	49	77	48.5	24
3	100	98	28	84	73	53	68	48	78	47.5	23
4	99.5	97	29	83.5	72	54	67.5	47	79	46	22
5	99	96	30	83.5	71	55	67.5	46	80	46	21
6	98.5	95	31	83	70	56	67	45	81	45	20
7	96.5	94	32	82.5	69	57	66.5	44	82	44	19
8	94.5	93	33	81.5	68	58	66	43	83	44	18
9	94.5	92	34	81	67	59	65	42	84	38	17
10	93.5	91	35	80	66	60	65	41	85	36.5	16
11	93.5	90	36	79.5	65	61	64	40	86	36	15
12	93	89	37	79	64	62	63	39	87	34.5	14
13	92.5	88	38	78.5	63	63	62	38	88	34.5	13
14	92.5	87	39	77.5	62	64	59.5	37	89	32.5	12
15	92.5	86	40	77.5	61	65	59.5	36	90	32.5	11
16	92	85	41	76	60	66	59	35	91	30	10
17	91.5	84	42	74.5	59	67	59	34	92	28.5	9
18	91	83	43	74	58	68	58.5	33	93	26.5	8
19	89	82	44	74	57	69	58.5	32	94	20	7
20	86	81	45	73	56	70	55.5	31	95	18.5	6
21	85.5	80	46	73	55	71	54.5	30	96	17	5
22	85.5	79	47	73	54	72	54	29	97	12.5	4
23	85	78	48	71.5	53	73	53.5	28	98	6.5	3
24	85	77	49	71.5	52	74	53	27	99	4.5	2
25	85	76	50	69.5	51	75	52	26	100	4	1

% Range	0-10	10-20	20-30	30-33	33-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of Students	3	4	3	2	5	8	12	14	15	16	18

Note:

Range (x-y) means data elements between x and y exclusive of x and inclusive of y.

Example:

Range (20-30) means data elements between 20 and 30 exclusive of 20 and inclusive of 30.

Let us see how grading will be done for the given database.

SAMPLE CASE

Let Passing Percentage be 33%, Then

Highest percentile score among the students who has failed (FP) = 12.00

Percentage of pass students (PP) = $100 - 12.00 = 88.00$

Therefore, failed student will be divided into 3 equal groups and grade will be given to corresponding group as:-

Percentile Range	0.00-4.00	4.00-8.00	8.00-12.00
Grade	F3	F2	F1

Similarly, passed student will be divided into 7 equal groups and grade will be given to corresponding group as :-

Percentile Range	12.00-24.57	24.57-37.14	37.14-49.71	49.71-62.28	62.28-74.85	74.85-87.42	87.42-100
Grade	D	C2	C1	B2	B1	A2	A1

Therefore, the output after grading will be as follows :-

Rank	% Marks	Grade	Rank	% Marks	Grade	Rank	% Marks	Grade	Rank	% Marks	Grade
1	100	A1	26	84.5	A2	51	69	B2	76	49	C2
2	100	A1	27	84	B1	52	69	C1	77	48.5	D
3	100	A1	28	84	B1	53	68	C1	78	47.5	D
4	99.5	A1	29	83.5	B1	54	67.5	C1	79	46	D
5	99	A1	30	83.5	B1	55	67.5	C1	80	46	D
6	98.5	A1	31	83	B1	56	67	C1	81	45	D
7	96.5	A1	32	82.5	B1	57	66.5	C1	82	44	D
8	94.5	A1	33	81.5	B1	58	66	C1	83	44	D
9	94.5	A1	34	81	B1	59	65	C1	84	38	D
10	93.5	A1	35	80	B1	60	65	C1	85	36.5	D
11	93.5	A1	36	79.5	B1	61	64	C1	86	36	D
12	93	A1	37	79	B1	62	63	C1	87	34.5	D
13	92.5	A1	38	78.5	B1	63	62	C1	88	34.5	D
14	92.5	A2	39	77.5	B2	64	59.5	C2	89	32.5	F1
15	92.5	A2	40	77.5	B2	65	59.5	C2	90	32.5	F1
16	92	A2	41	76	B2	66	59	C2	91	30	F1
17	91.5	A2	42	74.5	B2	67	59	C2	92	28.5	F1
18	91	A2	43	74	B2	68	58.5	C2	93	26.5	F2
19	89	A2	44	74	B2	69	58.5	C2	94	20	F2
20	86	A2	45	73	B2	70	55.5	C2	95	18.5	F2
21	85.5	A2	46	73	B2	71	54.5	C2	96	17	F2
22	85.5	A2	47	73	B2	72	54	C2	97	12.5	F3
23	85	A2	48	71.5	B2	73	53.5	C2	98	6.5	F3
24	85	A2	49	71.5	B2	74	53	C2	99	4.5	F3
25	85	A2	50	69.5	B2	75	52	C2	100	4	F3

DEPENDENCIES

The only dependency in our case is the Student Database which is to be provided by the examination board.