

Use of Information Technology in University Examination: Facilitating Decision Making

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Abstract

We described a system developed in the computer unit of Sambalpur University. The software has not only simplified the growing complexities of University Examination System and publishing various examination result in time but also brought transparency in the system, minimized time, delivered error free result and provides vital information in contexts of decision making.

1 Introduction:

Sambalpur University conducts about 210 examinations in graduation and post graduation stages. Some of them are semester examinations, where the marks received are to combine with the internal assessment and over all marks are calculated. Others are annual examinations with 20% to 30% internal assessments or may be of 100% University examinations without internal assessment. It is often necessary to vary the boundaries to ensure that pass rates are appropriate or the marks awarded by examiners in a paper are consistent. Until recently this processing was done mostly manually or by some outside agency through computers resulting many errors which were rectified before publication of result. Three-year degree final examination result-1998 was processed by an outside agency. Almost 30% of the result were wrong. For example, 2604 candidates had appeared 1998 final year arts honors examination out of which the results of 847 candidates were found wrong. This constitutes 32.53%. To avoid such problem, University revived the computer unit to process all the confidential work. The required software were developed in the unit and some of the University staff were engaged in the unit with minimal training so that they can edit, take printouts of admit cards, candidate's nominal roll, tabulation registers, mark sheets and original certificates etc. So far not a single processing error has been detected. Although the initial impetus for this system was to stream line the process, it opened up a number of possibilities for the analysis of the examination results which were previously difficult to achieve. Thus, what started principally an administrative development has also had a pedagogical impact on the University.

2 A brief overview of the system

There are essentially four parts to the problem of generation of examination results:

- Scheduling timetable for the examination and issuing admit cards for the candidates and candidate nominal roll (CNR) for the examination centers.
- Received the raw marks from the examiners in a prescribed proforma provided by the unit and feeding these in to the system.
- Varying the pass boundaries of the candidates, if required.
- Compiling the result and uploading it to the Sambalpur University website.

2.1 Entering and Uploading Marks

The staffs of the unit enter the raw marks in personal computer's DBMS file. The personal computers are under LAN and raw marks are uploaded to a single computer system. After uploading the raw marks into the system, the Syndicate/Vice-chancellor of the university appoints some teaching staff to verify the entries. In some cases, the unit follows double entry system.

2.2 Varying the Pass Boundary

Although the university does not have rigid quotas for how many students should pass or receive first class or distinction, it does expect a certain degree of consistency. Examiners are given guidelines for valuation of papers and the unit is allowed to vary the boundary of the pass mark of a paper depending upon the performance of other papers. The unit considers varying the boundary of those candidates, who fail to secure the minimum qualifying marks in a subject prescribed earlier by the university or failing to secure next higher class by some marks or failing due to aggregate. First we classify the successful candidates and then vary the boundaries of unsuccessful candidates if they come under the prescribed rule of the University. For this we proceed as follows.

2.2.1 Notations

Let

$i = 1, 2, \dots, l$ - Number of examination to be conducted

$j = 1, 2, \dots, m$ - Number of courses to be offered

$k = 1, 2, \dots, n$ - Number of papers in a course.

$Max_Th_C_{ij_k}$ - maximum mark in the k^{th} theory paper of j^{th} course in i^{th} examination.

$Max_Pr_C_{ij_k}$ - maximum mark in the k^{th} practical paper of j^{th} course in i^{th} examination.

$MO_Th_C_{ij_k}$ - mark obtained in the k^{th} theory paper of j^{th} course in i^{th} examination.

$MO_Pr_C_{ij_k}$ - mark obtained in the k^{th} practical paper of j^{th} course in i^{th} examination.

p - minimum percentage required passing a theory paper

q - minimum percentage required passing a practical paper

r - minimum percentage required for aggregate

2.2.2 Classification of successful candidates

A candidate is said to have passed any examination if

- (a) $MO_Th_C_{ij_k} \geq Max_Th_C_{ij_k} * p$
for $i = 1, 2, \dots, l, j = 1, 2, \dots, m, k = 1, 2, \dots, n.$
- (b) $MO_Pr_C_{ij_k} \geq Max_Pr_C_{ij_k} * q$
for $i = 1, 2, \dots, l, j = 1, 2, \dots, m, k = 1, 2, \dots, n.$
- (c)
$$\sum_j \left(\sum_k (MO_Th_C_{ij_k}) + \sum_k (MO_Pr_C_{ij_k}) \right)$$

$$\geq \sum_j \left[\sum_k (Max_Th_C_{ij_k}) + \sum_k (Max_Pr_C_{ij_k}) \right] * r$$

for $i = 1, 2, \dots, l.$

2.2.3 Which students should be considered in varying their pass boundaries?

Here we have presented an algorithm in varying pass boundary of Arts (pass) examination followed by illustration.

Algorithm for varying pass boundaries for fixed i

Step-1:

If a candidate satisfies 2.3.2, skip else go to step-2.

Step-2:

If $\sum_k MO_Th_C_{ij_k} < u * \sum_k Max_Th_C_{ij_k}$ for any j, skip else go to step-3. Here u is prescribed in percentage.

Step-3:

$sum \leftarrow 0, num \leftarrow 0, tot \leftarrow 0, max \leftarrow 0$

For $j = 1, 2, \dots, m.$

If $\sum_k MO_Th_C_{ij_k} < p * \sum_k Max_Th_C_{ij_k}$

Calculate

$sum \leftarrow p * \sum_k Max_Th_C_{ij_k} - \sum_k MO_Th_C_{ij_k}$

$num = num + 1$

$tot = tot + sum$

$max = max + \sum_k Max_Th_C_{ij_k}$

end for.

Step-4:

For a prescribed s

If $num > s$, skip

If $tot > (u/num) * max$, skip, else go to step-5.

Step-5:

Raise the fail marks to minimum pass mark and go back to step-1 for the processing of next candidate.

[When skip is encountered, the whole algorithm is to be skipped and the process is to be continued for next candidate.]

Illustration of the Algorithm

For illustration of the algorithm we first present the Course structure for the first examination of Arts (pass) in Table-1.

	COURSE	No. of Papers	Maximum Marks	Pass Mark	No. of approved course by Univ.
A	Foundation-I	1	050	090	06
	Foundation-II	1	050		05
	Foundation-III	1	100		01
	Applied/Ancillary	1	100		16
B	English	1	100	030	1
C	MIL	1	100	030	6
D	Core-2	2 (both theory) or	200	060	24
		3 (2 Th. & 1 Pr.)	150+050	045+020	
E	Core-3	2 (both theory) or	200	060	24
		3 (2 Th. & 1 Pr.)	150+050	045+020	

Table-1: Course Structure of First examination Arts (pass)

In +3 Arts (pass) examination no division is awarded. A successful student is declared to have passed with distinction if he/she secures more than or equal to 50% marks in aggregate otherwise placed in with simple "Pass". A student may have offered subjects having only theory papers or all or any number of subjects with combinations of theory and practical papers. Varying of pass boundaries are considered in theory papers only. A student has to offer any two subjects from 24 courses, one as core-2 and the other as core-3. Anthropology, Computer Science, Education, Geography, Home Science, Statistics are subjects having practical papers and other subjects are having theory papers only. Depending upon the subjects offered by a candidate for core-2 and core-3, they can be placed under the group TT or TP or PT or PP where T represents a subject having only two theory papers and P represent a subject having two theory papers of 75 marks each and a practical paper of 50 marks. Since the possible subject combination of a student of First-degree examination is 1589760, we give code to each subject for preparation of the database. A student can be failed in any one way out of

$$\sum_{i=1}^5 {}^5C_i = 31 \text{ ways.}$$

Let us consider a hypothetical case for u=9 and s=3, then for

$$\sum_{i=1}^3 {}^5C_i = 25$$

Types of fail candidates will be considered for varying pass boundaries provided the candidate has not secured less than (30-u) percentage of maximum theory marks of A, B, C, D or E. The minimum requirement of marks in each category is given in Table-2.

Similarly, if a student secures minimum pass mark in each paper/subject but fails to secure the aggregate by v percentage of marks, then the theory paper marks are raised so that the student attains minimum aggregate pass marks. Numbers of students in different categories for the year 1999, 2000 and 2001 for Arts examination only are shown in Table-3.

3 Security

There are two aspects of security for a system such as integrity of the data and privacy. In order to preserve this, it is essential to ensure that only certain users can entry or edit marks and a single user is allowed to vary the boundaries. Both of these issues are addressed by requiring the users to identify themselves with a user name and password.

Category	1	2	3	4	5	6	7	8	9	10	11	12	13
Failing in	A	B	C	D	E	AB	AC	AD	AE	BC	BD	BE	CD
Group-TT	27	9	9	18	18	18	18	23	23	9	14	14	14
Group-TP	27	9	9	18	14	18	18	23	20	9	14	11	14
Group-PT	27	9	9	14	18	18	18	20	23	9	11	14	11
Group-PP	27	9	9	14	14	18	18	20	20	9	11	11	11

Continued.....

Category	14	15	16	17	18	19	20	21	22	23	24	25
Failing in	CE	DE	ABC	ABD	ABE	ACD	ACE	ADE	BCD	BCE	BDE	CDE
Group-TT	14	18	15	18	18	18	18	21	12	12	15	15
Group-TP	11	16	15	18	17	18	17	20	12	11	14	14
Group-PT	14	16	15	17	18	17	18	20	11	12	14	14
Group-PP	11	14	15	17	17	17	17	18	11	11	12	12

Table-2. Minimum Requirement of Varying Pass Boundaries.

Abbreviations used in Table-3 are as follows:

Arts Pass examinations	: AP
Arts Pass (Back) examinations	: APB
Arts Honours examinations	: AH
Arts Honours (Back) examinations	: AHB
No. of students enrolled	: EN
No. of students passed normally	: N
No. of students passed by Varying Boundaries	: VB
Total No. of students passed in the examination	: T


First Exam - 1998					Final Exam - 1999				First Exam-1999 Final Exam-1999		
Exam	EN	Pass			EN	Pass			Pass		
		N	VB	T		N	VB	T	N	VB	T
AP					8022	2791	1828	4619	2267	543	2810
APB					3595	628	724	1352	594	283	877
AH					2291	1392	265	1657	1054	205	1259
AHB					591	302	94	396	256	77	233
First Exam – 1999					Final Exam - 2000				First Exam-2000 Final Exam-2000		
AP	10276	2175	1936	4111	9227	1824	1987	3811	1909	375	2284
APB	5465	--	--	2704	3991	1048	907	1955	757	452	1209
AH	2677	1050	441	1491	2522	1054	397	1451	880	162	1042
AHB	877	--	--	397	679	257	108	365	187	82	269
First Exam – 2000					Final Exam - 2001				First Exam-2001 Final Exam-2001		
AP	9804	1415	1261	2676	8225	1848	1494	3342	1432	192	1624
APB	6698	1478	1216	2694	5303	1942	1045	2987	921	475	1396
AH	2801	713	382	1095	2516	1296	261	1557	865	68	933
AHB	1306	399	198	597	1044	557	161	718	372	155	527
First Exam – 2001					Final Exam - 2002				First Exam-2002 Final Exam-2002		
AP	9465	1374	1490	2864	7730	2247	1276	3523			
APB	7355	1324	1182	2506	4006	1811	632	2443			
AH	2789	947	364	1311	2513	947	1318	353			
AHB	1622	364	257	621	761	308	107	413			

Table-3: Number of Students in Different Categories
(The data have been generated by the author while processing the result)

4 Availability

After processing as per 2.2.3., the database is converted as per the requirement of the web publication to establish a link to active server page of the Sambalpur University website. An examinee can get his result and marks after submitting his/her roll number in the html page having link to the active server page.

Sambalpur University
Jyoti Vihar, Burla-768019, Sambalpur(Orissa)
+ 3 Final Result - 2002 (Back)
(Arts, Science, Commerce)



Enter Roll Number

Note: Sambalpur University is not responsible for any inadvertent error in the results being published on NET. The results published on net are for immediate information to the examinees. These cannot be treated as original mark sheets.

HTML Page for Submitting Roll Number

SAMBALPUR UNIVERSITY
+3 FINAL RESULT – 2002 (Back)
(Arts, Science, Commerce)

Roll No :
Name :
Result :
Total Core :
Total (Hons) :

FINAL YEAR INDIVIDUAL MARKS

CORE - I	CORE - II	CORE - III

Back

Active Server Page for Displaying Result & Mark

Interested readers can explore the system from the official website of Sambalpur University <<http://sambalpuruniversity.net>>. The University withdraws the file after one month of publication of the result.

5 Conclusion

Using a World Wide Web interface, the processing of examination marks has made a significant improvement on the convenience of students and has also opened up the way for a more detailed analysis.

6 Acknowledgement

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7 References

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Result booklets of Sambalpur University +3 Arts examinations for the year 1999, 2000, 2001 and 2002.