01 Sep 1983

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Recommended Citation

J. R. Metzner, "Proportional Advancement From Regional Programming Contests," *ACM SIGCSE Bulletin*, vol. 15, no. 3, pp. 27 - 30, Association for Computing Machinery, Sep 1983.
The definitive version is available at https://doi.org/10.1145/382188.382569

PROPORTIONAL ADVANCEMENT

from

REGIONAL PROGRAMMING CONTESTS

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There have been seven ACM International (nee National) Scholastic Programming Contests. While the first two had an open or invitational makeup, the last five have used a system of regional contests to identify capable teams for advancement to the International Contest. The regional structure chosen was the one available within ACM, the divisions used for its Regional Representatives.

The contest is administrated by an informal version of corporate organization with a Chairman in the role of Chief Executive Officer and a Panel of Judges serving as a Board of Directors. It is the Panel of Judges which deals with policy and procedure issues as the contest structure expands and evolves. Advancement to the International Contest is only one of the equity issues they perennially treat. Others include the eligibility requirements for team members, the availability and appropriateness of contest programming languages, the "home field" advantages of familiar dialects and editors, and the inherent disadvantages which smaller schools have when competing with larger ones.

The allocation of advancements has been a particularly tenacious equity question. It has been on the agenda of the annual meeting of the Panel of Judges in every one of the last five years. The basis for this concern is shown in Table I. That table shows the numbers of teams participating in Regional Contests over the last five years. Each region's participation is also given as a percentage of all teams participating that year. The disparities are striking and appear to be persistent. In the 1978-79 contests, a team placing third in a region hosting 25 teams (top 12% at its contest) did not earn an advancement to the National Contest while a team in another region had only to place in the top half at its contest to advance.

The reaction of the Panel of Judges to this situation has been, to say the least, deliberate. For two years they acknowledged the problem, discussed possible remedies, and deferred action in the hope that the condition would abate or disappear with time. When it stubbornly persisted, the Panel of Judges agreed upon the idea of seeking a National Contest host site which could accomodate more than 22 teams (two per U.S. Region - the initial advancement practice) and then award extra advancements on merit; for example, to regions affording contest experience to large numbers of teams. The more flexible advancement practice would also permit encouraging responses to inquiries from areas not previously participating, such as Europe and Australia.

However, the logistic reality is that hosts capable of accomodating more than 22 teams well are extremely scarce. The tradition of holding the International Contest in conjunction with ACM's Computer Science Conference dictates the locale of the contest and restricts the search for a host site to an economical bussing radius. By this time, the difficulty in finding host sites to accomodate more than twenty teams or so had prompted two regions to split their contests into two sub-regional contests.

The inbalance in regional participation levels persisted. To alleviate the problem with "bonus" advancements it would be necessary to locate a host site capable of accomodating far more than 22 teams. Having a contest field of that size would also dilute the funds available as Participation Grants to the point where qualifying schools might be financially unable to advance their teams. So, reluctantly, proportional advancement was adopted for the 1983 International Contest. To avoid rampant uncertainty and the disabling effects of late or unreported regional contests, the participation levels of the prior contest year were taken as a basis. The field

TABLE I

REPORTED REGIONAL PARTICIPATION

	1978-79		1979-80		1980-81		1981-82		1982-83	
Region	Teams	%	Teams	%	Teams	%	Teams	%	Teams	%
Allegheny	7	5.1	15	8.8	14	7.2	18	9.7	16*	6.4
Capital	8	5.8	8	4.7	9	4.6	11	5.9	14	5.6
East Central	25	18.1	25	14.6	29	14.9	25	13.4	36	14.5
Greater N.Y.	10	7.2	14	8.2	14	7.2	8	4.3	9	3.6
Mountain	14	10.1	12	7.0	17	8.7	13	7.0	18	7.2
North Central	21	15.2	28	16.4	28	14.4	33	17.7	41	16.5
Northeast	6	4.3	10	5.8	16	8.2	16	8.6	19	7.6
Pacific	5	3.6	6	3.5	7	3.6	6	3.2	8	3.2
South Central	17	12.3	20	11.7	23	11.8	23	12.4	40	16.1
Southeast	21	15.2	27	15.8	32	16.4	24	12.9	33	13.3
Southern Calif.	4	2.9	6	3.5	6	3.1	9	4.8	15	6.0
Total	138	99.8	171	100.0	195	100.1	186	99.9	249	100.0

* No Report, Estimated from Hearsay

size was left flexible so that the number of teams accomodated could vary, depending upon host site capacity from year to year. The effect of this practice is shown in Table II.

The absolute and percentage levels of participation given in the first two columns are repeated from the prior table. Added here are columns showing absolute and percentage advancements and the disparity for that year as percentage differences. The absolute and percentage advancements under the proportional basis for the 1983 International Contest are given next. The rightmost column shows the drastic reduction in disparity achieved. Whether our practice should minimize the maximum absolute value in that column or the sum of squares of its entries is a technical nicety open to discussion. However, equity is visibly improved.

This same information can be presented in a form much closer to the student contestant's concern for equity. In Table III, the advancements are computed as percentages of each region's competing teams.

TABLE II

PARTICIPATION AND ADVANCEMENTS

	1981-82					1982-83		
Region	Teams	%T	Advs.	%A	%A-%T	Advs.	%A'	%A'-%T
Allegheny	18	9.7	2	9.1	-0.6	2	8.3	-1.4
Capital	11	5.9	2	9.1	+3.2	2	8.3	+2.4
East Central	25	13.4	2	9.1	-4.3	3	12.5	-0.9
Greater N.Y.	8	4.3	2	9.1	+4.8	1	4.2	-0.1
Mountain	13	7.0	2	9.1	+2.1	2	8.3	+1.3
North Central	33	17.7	2	9.1	-8.6	4	16.7	-1.0
Northeast	16	8.6	2	9.1	+0.5	2	8.3	-0.3
Pacific	6	3.2	2	9.1	+5.9	1	4.2	+1.0
South Central	23	12.4	2	9.1	-3.3	3	12.5	+0.1
Southeast	24	12.9	2	9.1	-3.8	3	12.5	-0.4
Southern Calif.	9	4.8	2	9.1	+4.3	1	4.2	-0.6
Total	186	99.9	22	100.1		24	100.0	

TABLE III

REGIONAL PLACEMENT TO ADVANCE

	1981-82			1982-83		
Region	Teams	Advs.	Top%	Teams	Advs.	Top%
Allegheny	18	2	11.1	16	2	12.5
Capital	11	2	18.2	14	2	14.3
East Central	25	2	8.0	36	3	8.3
Greater N.Y.	8	2	25.0	9	1	11.1
Mountain	13	2	15.4	18	2	11.1
North Central	33	2	6.1	41	4	9.8
Northeast	16	2	12.5	19	2	10.5
Pacific	6	2	33.3	8	1	12.5
South Central	23	2	8.7	40	3	7.5
Southeast	24	2	8.3	33	3	9.1
Southern Calif.	9	2	22.2	15	1	6.7
Largest-Smallest			27.2			7.6

That is, a team has to place in the top n% at its Regional to advance, and the n's of the various regions should be equalized to the extent possible. Proportional advancement reduced the spread in these percentages dramatically in spite of the effects from basing advancements upon the prior year's levels of participation. The integral nature of the problem places a lower bound on reducing the spread; if regional participation had remained constant, the spread in 1982-83 would have still been over 7 percent.

Proportional advancement is open to a number of arguments. One is that computing activity is not equal across ACM's Regions, which were originally based upon general population figures. True, but they're the only districts ACM has and ACM Council itself gave up on redistricting, finding that distance problems in geographically large regions would be made worse by districts drawn to equalize ACM membership. Departing from ACM's Regions would deprive the contest structure of the support and participation of Regional Representatives it now enjoys.

It may be argued that post-secondary schools are not evenly divided among our regions. This consideration is behind the practice of counting teams which participate in regional contests rather than counting schools. Regional contests may admit more than one team from a single school and many do, accomodating second teams on a "space available" basis. So, a region with fewer but larger schools can offer wider participation by hosting more than one team from each school.

Perhaps teams at regionals are not the right counts to base proportional advancement upon. This gets at philosophical questions about who the contests are intended to serve. The motives of the volunteers staffing the contest effort have been to benefit ACM by bringing its presence to as many students as possible in the form of the best contest experience that resources permit. Contests open to students without regard to their ACM or Student Chapter affiliation will reach the most students. For many, the contests have been the first form of contact with any ACM activity. In some instances, contest participation has kindled a spark of interest which has led to the establishment of a Student Chapter. In any case, participation in Regional Contests is the point at which ACM resources come into play. If there are heats or qualifying contests which use ACM resources in reaching more teams than are shown in these tables, they have not been mentioned in the reports of contest structure, problem set, and results each region is asked to submit each year.

Delaying the "payoff" for increased participation by using the previous year's team counts as the basis for proportional advancement is just one of many anguished compromises forced by the realities of contest administration. The planning cycle for the International Contest spans more than a year. One of the reasons for its length is to relieve the crush of duties falling upon its volunteers in the final three or four months before the contest. Having to allocate advancements, exchange information, check contestant eligibilities, calculate participation grants, and respond to numerous inquiries would intolerably tax the contest's administration during the crucial period of peak effort just before the International Contest, when the Regional Contest organizations are no longer in place

to help.

There are other operational problems; the time available for teams to make travel and funding arrangements would be greatly reduced. Teams in all regions would be left in a state of uncertainty until the last Regional Contest is held and reported. A snow storm or system failure could easily force a Regional Contest scheduled for early December to be postponed until Mid-January when school sessions resume. While beyond control, the resulting delay in opportioning advancements could well imperil the International Contest. Consider also the plight of the Regional Contests if their organizers didn't know how many advancements they had to determine clearly and fairly and if their participants didn't know how well they had to place to advance.

There remains the argument that proportional advancement doesn't necessarily identify a field of the most capable teams. To approach that ideal would take a greatly expanded and concerted effort far beyond the resources available. The uncertainty inherent in comparing teams that did not compete in the same contest are so great that it could be attempted only after forcing all regional contests to be held the same day, using the same problem set. Even then, the effects of variations among contest systems, conditions, and environments would cast serious doubts on the validity of the process.

Another tack would be to leave the regionals as they are but use the performances of each region's teams to bias the number of advancements the region would receive the following year. This presumes that the performances of advancing teams are a reliable indicator of the prowess of that region's teams which did not advance and that the strengths of all teams are likely to be present the following year, after a substantial fraction of the participants have graduated. The presumptions may be valid, but they are at least debatable.

Regardless of whether or not proportional advancement can be improved, it only has to perform more equitably and produce a more balanced field than the former procedure of allocating two advancements to each region. It certainly has done so in 1983. Two thirds of the 24 teams scored 3 to 5 solutions on the 6 problems posed. The region earning four advancements had three of its teams finish in the top six places. In fact, the First Place team at the International Contest would not have been included in the field if its region had had one less advancement.

National Scholastic Programming Contest

Thanks are in order to Dr. Lionel E. Deimel Jr. of the Department of Computer Science, North Carolina State University for forwarding a revised set of the 1983 contest problems for publication and to his Contest Co-Chairman Dr. Charles P. Pfleeger, Department of Computer Science, University of Tennessee. Dr. Deimel Jr. traces his contest involvement from team preparation and contest operating system development in the Southeast Region during the late 1970's. He has been a member of the Panel of Judges of the National Contest since the 1980-81 contest year, serving additionally as Chief Judge the following year. Dr. Deimel is the current Contest Chairman. Dr. Pfleeger joined the contest effort as a judge in the 1978-79 season and has remained on the Panel of Judges ever since. He was the Chief Judge for the 1980-81 contest and Contest Chairman the following year.

Dr. John R. Metzner, author of the previous article, has been involved with all seven National Contests as a judge and was the Contest Chairman for three of them. He has been the Contest Co-Ordinator of the North Central Region for five years, was the Contest Organizer for a regional contest, and twice served as Chief Judge for one of its sub-regional contests.