6 to 8 inch pot to make a little cone which would encourage the old roots to grow outward and downward rather than around in a mass. Mix was added around the sides and tamped in with fingers and thumbs to firmly place the soil in the new pot. Young bare-rooted cuttings were also available for transplanting into 4 inch containers.

Plant Identification. Upon completion of the tasks, children were given descriptive tours of the various stock plants and potted crops grown in the greenhouses. The hardiest interior plantscaping species were emphasized.

General Considerations

The main objective of the Horticultural Therapy activities on "Super Saturday" was to provide exposure to horticulture and plant science. The children were to be introduced to the vital role plants play in our lives as humans (17). The second objective was to make sure everybody had plants to take home with them.

No effort was made to segregate the two groups of children during the activities; their interaction is part of the "Super Saturday" programming concept. The hay ride field trip provided a good introduction and was particularly successful because it had everyone excited. It worked quite well to separate the morning session into Type I exposures, which prepared them for the related Type II tasks which were completed in the afternoon. Original plans to break into individual groups that afternoon proved to be unsatisfactory. Every task was performed separately as one group, taking about 30-45 minutes for each activity. The terraria, the plant propagation, and the transplanting activities provided successful Type II learning, and everybody was excited because they got to take plants home.

Summary

Horticultural Therapy activities were very successful with special education children, and provided good experimental training for the Horticultural Therapy students. The broad range of activities captured the attention of everyone, including the supervising aides. Children were able to interact among themselves and our students, and questions were asked during each activity. Hands-on activities allowed our Horticulture Therapy students to practice their training by teaching others and also kept the children motivated to complete their tasks. Horticulture is continuing to be offered to the Special Education program.

References

1. Airhart, D.L. and J. Tristan. "Horticultural Therapy for Special Education Students." *HortScience* 22,6 (December 1987), 1332.

2. Airhart, D.L., and J.D. Cronin. "Gardening Ideas for Physically Handicapped Individuals." *HortScience* 16,1 (March 1981), 461.

3. Clark, B. *Growing Up Gifted: Developing the Potential of Children at Home and at School.* 2nd Edition (1983), Charles Merrill Company. 489 pp.

4. Cornille, T.A., G.E. Rohrer, S.G. Phillips, J.G. Mosier. "Horticultural Therapy in Substance Abuse Treatment," *Journal of Therapeutic Horticulture.* II (November 1987), 3-7.

5. Daubert, J.R. and E.A. Rothert, Jr. *Horticultural Therapy at a Psychiatric Setting.* Chicago Horticultural Society. 1981.

6. Doxon, L.E., R.H. Mattson, A.P. Jurich. "Human Stress Reduction Through Horticultural Vocational Training." *HortScience* 22,4 (August 1987), 655-656.

7. Hartmann, H.T. and D.E. Kester. *Plant Propagation.* 4th Edition (1983). Prentice Hall, Incorporated. 727 pp.

8. Hefley, P.D. "Horticulture: A Therapeutic Tool." *Journal of Rehabilitation.* 39,1 (January-February 1973), 27-29.

9. Houseman, D. 1980. "Developing Links Between Horticultural Therapy and Aging." *Journal of Therapeutic Horticulture* I, (November 1980), 9-14.

10. Relf, D. "Dynamics of Horticultural Therapy." *Rehabilitation Literature* 42,5-6 (May-June 1981), 147-150.

11. Relf, P.D. "The Use of Horticulture in Vocational Rehabilitation." *Journal of Rehabilitation.* 47,3 (July/August/September 1981), 53-56.

12. Renzulli, J.S., S.M. Reis, L.H. Smith. *The Revolving Door Identification Model.* Creative Learning Press, Incorporated. 1981. 248 pp.

13. Renzulli, J.S. *The Enrichment TRIAD Model: A Guide for Developing Defensible Programs for the Gifted and Talented.* Creative Learning Press, Incorporated. 1977. 89 pp.

14. Smith, R.L. *Ecology and Field Biology.* Harper and Row Publishers, 1966. 686 pp.

15. Train, L. "The Effect of Horticultural Therapy in Maintaining the Life Satisfaction of Geriatrics." Masters Thesis, Horticulture Department, Kansas State University, Manhatten Kansas.

16. Wright, S. *Gardening: A New World for Children.* The MacMillan Company, 1957. 183 pp.

17. Zadik, Madelaine. "Teaching Horticulture With a Human Perspective." *NACTA Journal* 30, 1 (March 1986), 59-61.

Course and Instructor Schedules From Mathematical Models

Gordon L. Myer and
David K. Lambert

Introduction

A considerable amount of time can be spent in developing future course schedules and instructor assignments over a multi-semester time period. Certain undergraduate courses may be taught every semester or annually. Graduate courses may be taught annually, every third semester or once every two years. When the same instructor teaches both undergraduate and graduate courses the problem of allocating the instructor's teaching time given the constraints on course rotations can be perplexing. Departments will often have a traditional teacher/course rotation set up but more often the class schedules are always in a state of flux as sabbaticals are taken, foreign assignments are realized, new courses are added, and courses are terminated. The problem is probably more acute in departments where instructors are not teaching every semester because of research contracts and the instructor would prefer to have all teaching responsibilities occur in one semester.

Myer and Lambert are members of the Agricultural Economics Department, College of Agriculture, University of Nevada-Reno, Reno, NV 89557-0105.

Procedures

A mixed integer, goal programming model that can be used to assist in course scheduling is discussed in this paper. The model was designed to optimize four objectives: 1) each instructor should teach a certain number of courses over the time period considered, 2) the number of courses taught each semester should be reasonably uniform; 3) each course has a specified number of times it should be offered; and 4) instructors should be assigned to teach those courses for which they are best suited. The user of the program selects objectives in terms of what is important in the allocation process. For example, objective two may not be important in some departments in which case it does not have to be included in the model. The user designs the program to meet specific needs.

Once the objectives have been specified weights are assigned to each objective. The model is designed to minimize a weighted sum of the four objectives. These weights may be changed over time to meet changes in faculty resources, changes in student numbers, or to adjust for changes in the composition of courses offered. In fact, the user of the program will most likely find that when first using the program the weights will have to be adjusted.

A FORTRAN program was written to generate the course assignment problem in MPS (mathematical programming standard) format. The MPS file was then read into and solved using LINDO, a mathematical programming software package. Small problems were solved on a microcomputer. Large problems required the use of a mainframe computer. The theoretical development of the model is not discussed in this paper nor are the mechanics of using the program. The model and FORTRAN program can be obtained from the authors.

Example Problem

A small problem is presented to illustrate the use of this methodology in developing teaching schedules for a future multi-time period. The problem involves assigning four instructors to teach four different courses over four semesters. The target level for teaching course 1 is four times over the time period, course 2 three times, course 3 twice, and course 4 once. The target levels for the number of times an instructor teaches are four, four, one, and two for instructors 1 through 4, respectively. Table 1 is a listing of values associated with objective 4. These values are not to be confused with the weights discussed earlier. The values in Table 1 can be thought of as specifying the suitability and/or availability of each instructor to teach each course. For example, instructor 1 was given a value of zero for course 1 but given a value of .6 for teaching course 4. This means that instructor one was highly suited for course 1 but was given a fairly low suitability value for course 4. Instructor 2 was given a value of 1 for course 1 which means that the instructor was not suited to teach course 1. The program was designed such that the greater the assigned value the lower the suitability of the instructor to teach the course.

Table 1. Weights Associated with a Given Instructor Teaching a Given Course.

	Class			
Instructor	1	2	3	4
1	.0	.2	.2	.6
2	1.0	.4	.4	.4
3	.5	.5	.5	.5
4	.3	.4	.5	.6

NOTE: For simplicity, weights were kept constant over all four semesters.

The results in Table 2 do not exactly satisfy all of the target levels. Instructor one teaches five courses instead of four courses and course four is taught twice instead of once. These problems can, however, be solved quite easily by one of two methods. One method would be to change the weights and rerun the program until the desired target levels are reached. The other method is to let the individuals involved resolve the problem. For example, instructor two can substitute for instructor one in teaching course three in the last semester and drop the second semester assignment to course four. Instructor 1 was given a high suitability value for teaching course 1 and the program assigned all of instructor 1 teaching time to course 1. Alternatively, instructor 2 was given a highly unsuitable value for teaching course 1 and the program did not assign instructor 2 to teach course 1. Instructor 3 was assigned a constant value for all courses and the program assigned the single teaching time to course four, semester one

Table 2. Solution of the Class Assignment Example

	Semester			
Course	1	2	3	4
1	1	1	1	1
2	4	—	4	2
3	—	2	2	1
4	3	2	—	—

NOTE: Numbers in body of table are instructor identification numbers.

Conclusion

A major problem in constructing assignment type mathematical programming models is obtaining feasible solutions. A problem formulatios intended to show that optimal assignments can be made by careful choice of weights or by arbitration following identification of close-to-optimal assignments. The program developed here is useful in saving considerable time required in identifying feasible course and teacher assignments since the number of possible combinations can be immense. Additionally, the program is reasonably flexible allowing individual users to meet their specific circumstances.