Operations Research

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To cite this article:
Sheldon B. Akers, Jr., (1956) Letter to the Editor—A Graphical Approach to Production Scheduling Problems. Operations Research 4(2):244-245. https://doi.org/10.1287/opre.4.2.244

Letters to the Editor

A GRAPHICAL APPROACH TO PRODUCTION SCHEDULING PROBLEMS

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(Received January 31, 1956)

THE NOVEMBER 1955 issue of this JOURNAL contained an article by MISS JOYCE FRIEDMAN and myself in which we discussed the feasibility of applying various logical techniques to the solution of certain production scheduling problems * In this note I would like to outline briefly a graphical approach to the same problem which seems to offer a quick method of solution for the case of two Parts and n machines (or, by duality, two machines and n Parts) However, the possibility of extending this method to the general case is, at best, not apparent

Consider a typical two-Part problem in which the operating sequences are as follows *Part I*, $a_4\, b_2\, c_1\, d_5$, *Part II*, $a_2\, d_5\, b_3\, c_3$, where the subscripts denote the time, in hours, required for each operation Using a conventional XY-coordinate system, mark off to scale the various operations on Part I in order along the X-axis starting at the origin Do likewise for Part II along the Y-axis (see Fig 1) For each machine, shade in the rectangle defined by its corresponding operations on the two axes

Now, to denote a program for the production of these two parts we have merely to draw a continuous line from the origin to the point P All segments of the line must be either horizontal, vertical, or at a 45-degree angle (up to right), and the line must not cross any of the shaded areas

An examination of this procedure shows that the 45-degree portions of this 'program line' correspond to operations simultaneous in time on the two parts, the horizontal portions to operations only on Part I and the vertical portions to operations only on Part II The 'shortest' such line corresponds to the program which permits both parts to be completed in the minimum time In finding the shortest line, however, one must consider the *projections* (on an axis) of the 45-degree segments Thus the 'length' of a particular program line is

$$\sum(\text{vertical segments})+\sum(\text{horizontal segments})+(1/\sqrt{2})\ \sum(\text{45-degree segments})$$

In the above example the length of the shortest program is 14 hours

* S B AKERS AND J FRIEDMAN, "A Non-numerical Approach to Production Scheduling Problems," *Opns Res* **3**, 429–442 (1955)

Finally, the actual program corresponding to a particular 'program line' results from doing Part I before Part II on all machines appearing *above* the line (i e , *b* and *c* in this example) and doing Part II before Part I on all machines appearing *below* the line (*a* and *d*) In the notation of the referenced article, all letters below

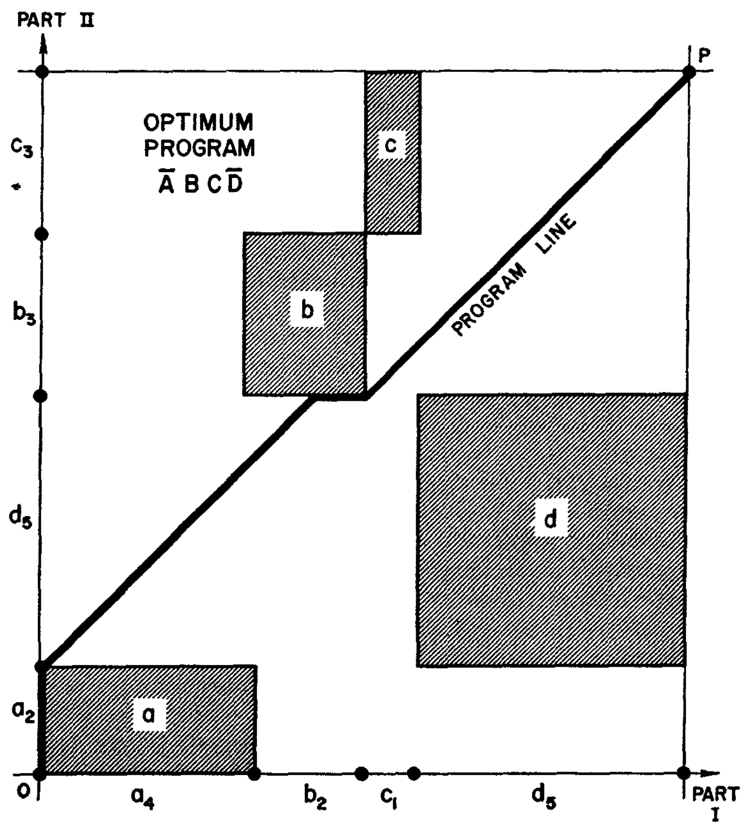

Figure 1

the line are unbarred, and above the line they are barred, so that here the optimum program is $\bar{A}BC\bar{D}$

I leave the general case of tracing a program line through an n-dimensional space dotted with n-dimensional rhombohedrons to the projective goemetricians