OPERATIONS RESEARCH SOCIETY OF SOUTH AFRICA
OPERASIONELE NAVORSINGSVERENIGING VAN SUID-AFRIKA

NUUSBRIEF   MEI 1974
NEWSLETTER   MAY

1.   LIDMAATSKAP/MEMBERSHIP

      Ons kondig met genoeë die volgende nuwe volle lid aan:

      We are pleased to announce the following new full member:

      M.A. de Vries - Pretoria

2.   BROSJURE OOR LOOPBANE IN O.N. IN SUID-AFRIKA / BROCHURE ON CAREERS
      IN O.R. IN SOUTH AFRICA

      'n Subkomitee van die uitvoerende komitee is tans besig met die
      opstel van dié brosjure. Dit is nodig om inligting te kry oor
      die sektors waarin lede werk, asook hulle akademiese agtergrond
      en inkomste. Lede word dus gevra om hulle komitee te help deur
      die aangehegte vorm te voltooi, en dit aan die redakteur terug
      te stuur. Dankie.

      A subcommittee of the executive committee is at present busy with
      the compilation of this brochure. It is necessary to obtain in=
      formation on the sectors in which members work, as well as their
      academic background and incomes. Members are thus asked to assist
      their committee by completing the attached form and returning it
      to the editor. Thank you.

3.   LIDMAATSKAPFOOIE / MEMBERSHIP FEES

      Rekeninge vir lidmaatskapfooie is reeds aan alle lede gestuur. 'n
      Vriendelike beroep word op lede gedoen om hul rekeninge sonder ver=
      suim te vereffen.

      Accounts for membership fees have already been sent to all members.
      A friendly request is made to members to settle their accounts
      without delay.

4.   SECOND INTERNATIONAL DISCUSSION CONFERENCE ON O.R.

      The First International Conference on Operations Research was held at
      Oxford in 1971. It was an experiment in an entirely different way
      of running conferences. Its unique feature was that there were no
      formal papers. Instead, about 25 eminent persons in the O.R. and
      contiguous spheres were each invited to lead a discussion on a

subject of particular current interest to himself. The experiment
was a great success, and the Second International Discussion Confe=
rence on O.R. will be held from 8 to 12 July 1974 at Edinburgh,
Scotland. The conference is recognised by IFORS. More informa=
tion about the Conference may be obtained from the Secretary.

5. <u>CASE STUDY FROM "A NOVENNA TO ST. JUDE"</u>

By courtesy of the editor of the TIMS journal "INTERFACES" we will
be reproducing over the next few months four case studies in
light-hearted vein, but nevertheless demonstrating valuable points,
taken from the article "A Novenna to St. Jude, or Four Edifying
Case Studies in Mathematical Programming" by R.E.D. Woolsey.

St. Jude is quoted by the author as the patron saint of lost
causes.

<u>The Inflexible Steel, Inc, Blast Furnace Model</u>

I was invited to give a talk to the Amalgamated Iron and Steel
Engineers in a nameless town. When I came, the Industrial Engineers
group gave me the usual tour, showing me the blast furnace, the
rolling mill and so forth. They then asked if they might give me
their presentation on how they were using LP in blast furnace
burdening. They had formed an objective function where they
were minimizing the cost per ton of finished steel per ton of ore of
type j times the amount of the jth ore. In symbols we have

$$\sum_{j=1}^{j=n} c_j x_j, \tag{1}$$

where c_j is the cost per ton of finished steel per ton of ore and

x_j is the amount of ore of type j in tons. The first constraint

was their sintering plant capacity constraint. We have that

$$\sum_{j=1}^{j=n} s_j x_j \leqslant S, \tag{2}$$

where s_j tons of sinter per ton of input ore, and S is the sintering

plant capacity. At this point he added that they're only dealing
with seven ores. Now, so far we're minimizing, subject to one
less than or equal to constraint. So, at this point, I've got
the feasible solution in my head. The next constraint was the
"net tons of hot metal constraint." Where h_j is the net tons

of hot metal per ton of input ore, or

$$\sum_{j=1}^{j=7} h_j x_j = NTHM \qquad (3)$$

And he said this is also called our "goal constraint." They wanted to hit this right on the button, thus the equality. At this point, I think to myself: "six variables." And then he told me that they got a trainload of x_3, the Woody Creek ore

every week, and they <u>had</u> to use it up; therefore x_3 is always

a constant known beforehand. In short,

$$x_3 = k_3 \qquad (4)$$

I'm thinking: "Five variables." Then he stated that of the last three ores, management kept telling them they were going to have all three, but that they had never had more than one at a time. The one they usually had was x_5, the U. S. Fines Stock Material.

And further, x_4, the Sunrise Fine ore, they had never had any.

In symbols,

$$x_4 = 0, \; x_6 = 0, \; x_7 = 0. \qquad (5)$$

And I'm thinking: "this has got to be some kind of joke, there are only two variables left." The last constraint turned out to be that they required when they used the first two ores, that they always had to be in a set ratio to each other. In symbols

$$rx_1 = x_2 \qquad (6)$$

I said, "Is that all?" He said, "Yes." I said, "You've been running this on an LP, right?" "Right." How long have you been doing this?" "Three years." "Do you do this on your own computer?" "No, no. We buy time." "You set it up every time, is that right?" "Oh, yes." I then asked them to go through it again. I wanted to make sure I was getting it right. So, they went through it again, and it was revealed that the last constraint had three cases,

the ratio case was case 3. Case 1 was where they got a trainload of x_1 and had to use it up. And case 2, ditto for the second ore.

In symbols,

$$x_1 = k_1 \text{ (Case 1)} \quad \text{or} \quad x_2 = k_2 \text{ (Case 2)}. \tag{7}$$

I asked them if they had any data for this model that I could see. So they brought me a listing of their last run (a case 3 situation). I looked at the data and asked for a slide rule, which was brought. I then sent them out to get me a cup of coffee. When they came back I said, "Well, the way I look at this data, you're going to have about 219 tons of Sunrise Ore, 352 tons of Comstock, 51 tons of Woody Creek (a constant) and 146 tons of U. S. Fines Stock Material." The guy said, "You know, I've never seen anybody sim= plex in their head before, you must have done a lot of LP's.

I then pointed out that in all three cases their model boiled down to minimizing one variable subject to that one variable being greater than or equal to a constant. In symbols,

$$\text{Minimize } x_j \text{ (where } j = 2, \text{ for case 1, and } j = 1 \text{ for case 2 and 3)}$$
$$\tag{8}$$
$$\text{Subject to } x_j \geq \text{Constant}.$$

Further, whichever one of the last three ores is present can always be determined by the following formula:

$$x_k = \text{Constant}_1 - \text{Constant}_2 * x_j \text{ (where } k = 5,6,7). \tag{9}$$

I then pointed out that a nomogram could be easily constructed, cast in steel and bolted to the wall of the blast furnace for the operator to use. The facts of the matter turned out to be that they had been preparing data for this program, for some three years and running it on a time-sharing computer in another city.

Now I am sure that there is a self-satisfied smirk on the face of most of my readers at this point, because you are sure that _you_ would never do anything like _this_. But now let's back up and ask ourselves the question that I ask my classes when I tell them this story. "Were these people bad engineers?" The answer is that they were very _good_ engineers. Their model did what it was supposed to do, it even did it optimally. The only problem was that they got so wrapped up in the method that, after the initial formulation, the model was no longer necessary. They did it _right_, they just

did it with more power than they needed. In short, they did
with more when they could have done with less.

6. NUWE PROFESSORS IN ONSA

Twee van ons lede het onlangs Professors geword, naamlik Prof.
G. Geldenhuys (Stellenbosch, Toegepaste Wiskunde), ons huidige
Sekretaris, en Prof. M. Venter (RAU, Statistiek) die vorige
nuusbrief redakteur. Hartlik geluk aan hulle albei.

7. TAKNUUS / CHAPTER NEWS

7.1 Western Cape

The Western Cape chapter would like to offer its congratu=
lations to Professor C. Geldenhuys on his appointment to
the chair of Applied Mathematics at the University of Stel=
lenbosch. Professor Geldenhuys is currently secretary of
ORSSA.

The next meeting of the chapter will be held on Wednes=
day, 5th June at 8.00 p.m. The topic will be critical
path scheduling in the construction of the Nico Malan
theatre complex, and a film on this topic will be shown
It is hoped that a representative from Murray ε Stewart
(Pty) Ltd (the construction company involved) will also
be present. There will also be a tour of the theatre
complex. The exact venue will be announced later in a
circular to members.

We are keen to establish contact with OR men round the
country. If you know of local or overseas men who intend
visiting the Cape please let us know so that we can set up
informal discussions or formal contact at our Chapter
meetings. Correspondence in this connection should be
addressed to:

Mr. J.F. Hofmeyer,
c/o Caltex Oil (S.A.) (Pty) Ltd.,
P.O. Box 714,
CAPE TOWN
8000

7.2 Pretoria

Die Pretoria tak het op Woensdag 22 Mei in die Arcadia Hotel
vergader, om 'n lesing te hoor van mnr. Dirk Laurie oor die
model wat hy gedurende die jongste verkiesing vir voorspel=
ling van uitslae gebruik het. Hierdie welbekende aspek
van Operasionele Navorsing het heelwat lewendige bespreking
uitgelok, veral as gevolg van die teenwoordigheid van 'n

vooraanstaande staatsleer deskundige.

7.3 Joint meeting - Pretoria and Johannesburg

A meeting is planned for 12 June at 20 h 00 in The
Casa Mia Hotel, Berea, Johannesburg, at which the speaker
will be Dr J. Kowalik, joint author of two books in
optimisation theory and application.

Dr Kowalik will be speaking on a case study of the
optimisation of a hydro-electric power generation network.
He will be speaking at a reasonably non-mathematical level,
and thus the meeting will also be of interest to these in
management positions interested in the potentialities
of the O.R. approach in very large scale problems. The
more detailed mathematics of this study will be given
subsequently as the final talk in the series of lectures
in numerical optimisation methods being given at the CSIR.

More details will be circulated to local members
shortly.

1. Lidmaatskap - ONSA:
   Membership - ORSSA:

Volle Full	Mede Assoc.

2. Sektor:
   Sector:

Opvoedkundige Educational	Ander Navorsing of Konsultasie Other Research or Consulting	Staatsdiens Civil Service

Provinsiale-/ Stadsraad Provincial/ City Council	Mynbou Mining	Vervaardiging Manufacturing

Assuransie, Bank ens. Insurance, Banking etc.	Handel Trading

Ander (spesi= fiseer asb.): Other (please specify):

3. Het u organisasie 'n spesifieke
   O.N. Afdeling?
   Has your organization a specific
   O.R. Section?

Ja Yes	Nee No

4. Beroep (as dit nie O.N. is nie) ....
   Occupation (if it is not O.R.)

5. Hoogste akademiese kwalifikasie:
   Highest academic qualification:

Geen graad No degree	Baccalaureus Bachelors	Honneurs Honours	Meesters Masters	Doktor Doctor

6. Ondervinding: Jare vanaf: Eerste Graad   ....
   Experience: Years since: First Degree

                                          Hoogste Graad ....
                                          Highest Degree

7. Bruto Jaarlikse Inkomste:
   Gross Annual Income:

<R4 000	R4 000 -6 000	R6 000 -8 000	R8 000 -10 000	R10 000 -12 000	R12 000 -14 000	>R14 000

Stuur aan: Return to:

                          T.J. Stewart

P/a NNWW,   C/o NRIMS,
Posbus 395,   P.O. Box 395,

                          PRETORIA

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