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Releasing of the Pressed Body Parts Production

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SUMMARY

The article presents the simulation of a production program in a car body Press Shop using the releasing theory. The releasing algorithm has been tested on a press line during a month, using for calculations the critical section concept, understanding by this the total quantities q_i for each item R_n which can be retrieved in production composition and will be achieved

***Keywords**: simulation, production, program*

The Press Shops of the automobile industry have a characteristic strafing and stroking production of the extremely high press lines.

Due to the special problems that can occur (equipment defects, broken dies, blocking due to lack of metal sheet) the follow-up problem and production programming has to be given a special attention because a syncope, a misprogramming, a broken die during the production process can lead to blocking the entire production flow until T/C Final Shop.

It has to be specified that in the automobile industry a single die set is used, there are no doubles in case of dies damaging.

The following presentation is a terse summary of the application, and emphasizes the simulation component – that is planning.

1. General goals

The releasing algorithm wants to establish, in the simulation regime, the item manufacturing schedule, for H1 press line, during a month, by running, in the simulation regime, repeatedly, the algorithm, using a time lens (a time interval chosen flexibly by the operator).

As a result of each simulation, we have the item manufacturing schedule on H1 line, including:

- Their launching order, considering the items will be grouped on families, based on the die code used for manufacturing;
- Launched and released quantities on each interval;
- The extra quantities manufactured, for the items planned on export on selected month and year;
- It is taken into account, in establishing the final quantities, manufactured in the interval, the maximum storage capacity and the current stock of that item;
- We have a schedule (calendar) for releasing each item, which includes the manufacture starting date, beginning hour and minute – and manufacture finishing date / item, hour and minute;
- We also increase the scheduled quantities, as well as the claimed production quantities, using for this the acceptability rate of each item;
- For calculating, we use the critical section concept understanding by this total q_i quantities for each item r_i, that are claimed by production component, and imposed to be achieved, with necessity; available working time on selected interval (extracted from the monthly working schedule) must be compared with the critical section release time:

- if available time is shorter than the time requested by the section, there will be items of which the production schedule will be achieved entirely, and an item subset of which the finishing date can be found on the right side, on the time axis, related to the right limit of the working interval. In order to satisfy the critical section, there is the possibility to run the algorithm by adding a time correction (adding hours or even entire shifts to the daily working schedule, which leads to increasing the final hour of the working day on the entire month), fact that supplements the available working time on the interval;

- if available working time is longer than the time requested by the critical section, then Tr, the section releasing time is used for manufacturing the section items, of the quantities requested by the section, and the suplementary Td – Tr time is used for supplementing the manufactured quantities of each item, on the condition that the item on which the quantity is supplemented should have an export schedule. Still, the manufactured supplementary quantities cannot overpass the difference between the maximum storage capacity / item and current stock of the given item;

For calculating the manufacturing time quantities / item, we use time rules from working sheets (assembly / dismantling / adjustment / dies adjustment and strokes...); the algorithm operates by increasing the working time for two reasons: to correct, if necessary, the working sheets unconformities, and to compensate the immobilising statistic times from the accidental times.

In the situation in which, during a month interval, by running chainly the algorithm, quantities which will be manufactured in the next month come out, these can be memorized and included, in the schedule, next month.

2. Initial data

2.1. Structure of the interface with PRODUCTION COORDINATION

The application interface with the coordination department of production it is followed by a file of which the structure is shown in the table below.

The file assures the writing, on variable time intervals (beginning of the working month, end of the first week, of the second week, etc...), quantities planned for production, export, and for spare parts.

At the same time, the quantities manufactured in the Press Shop for each item must be written down in the file, with an at least daily frequency.

Table 1. Interface with PC (production coordination)

NO.	[illegible]	[illegible]
1	*Nr_com*	*Order number*
2	*Plan_vers*	*Schedule version*
3	*Plan_luna*	*The month which is scheduled*
4	*Plan_an*	*The year which is scheduled*
5	*Data_com*	*Order date*
6	*Cod_reper*	*Scheduled item code*
7	*Tip_veh*	*Vehicle type*
8	*Qty_plan*	*Total scheduled quantity / item*
9	*Qty_prod_tot*	*Scheduled quantity for Production*
10	*Qty_prod_day*	*Scheduled quantities vector / days (production)*
11	*Qty_exp_tot*	*Export scheduled quantity*
12	*Exp_due_date*	*Delivery date for export order*
13	*Qty_ps*	*Total spare parts scheduled quantity*
14	*Stoc_curent_prod*	*Current stock for production*
15	*Stoc_curent_exp*	*Current stock for export*
16	*Qty_realiz_prod*	*Achieved quantity for production*
17	*Qty_realiz_exp*	*Achieved quantity for export*
18	*Qty_ramas_prod*	*Quantity to be achieved for production within the next month*
19	*Qty_ramas_exp*	*Quantity to be achieved for export within the next month*
20	*Ps_due_date*	*Delivery date for spare parts order*
21	*Qty_realiz_prod_day*	*Quantity achieved on days, for production*
22	*Qty_realiz_exp_day*	*Quantity achieved on days, for export*

2.2. Interface management

To Tk > To ... Tk+1 Tp1 ... Tk+j ... Tp2 ... Tk+m Tpn Ti

1 ... 31

This is the time axis, on a random month, between the 1st of the month and last day of the month.

Interface is supplied with data on the following time points:

To – schedule initialization on month plan_luna, and year plan_an; All fields must be filled in, the achievement ones being null;

Tp_1... Tpn - schedule extention (by addition) for a new time interval; The following fields are modified:

Qty_plan
Qty_prod_tot
Qty_prod_day , for days consecutive to those effectively loaded at To;
Qty_exp_tot
Qty_ps

Tk, Tk+1, Tk+m – it's writing the daily achievents for production, export and spare parts, the stocks are aligned to the process values. The following fields are updated:

Stoc_curent_prod
Stoc_curent_exp
Qty_realiz_prod
Qty_realiz_exp
Qty_realiz_prod_day
Qty_realiz_exp_day

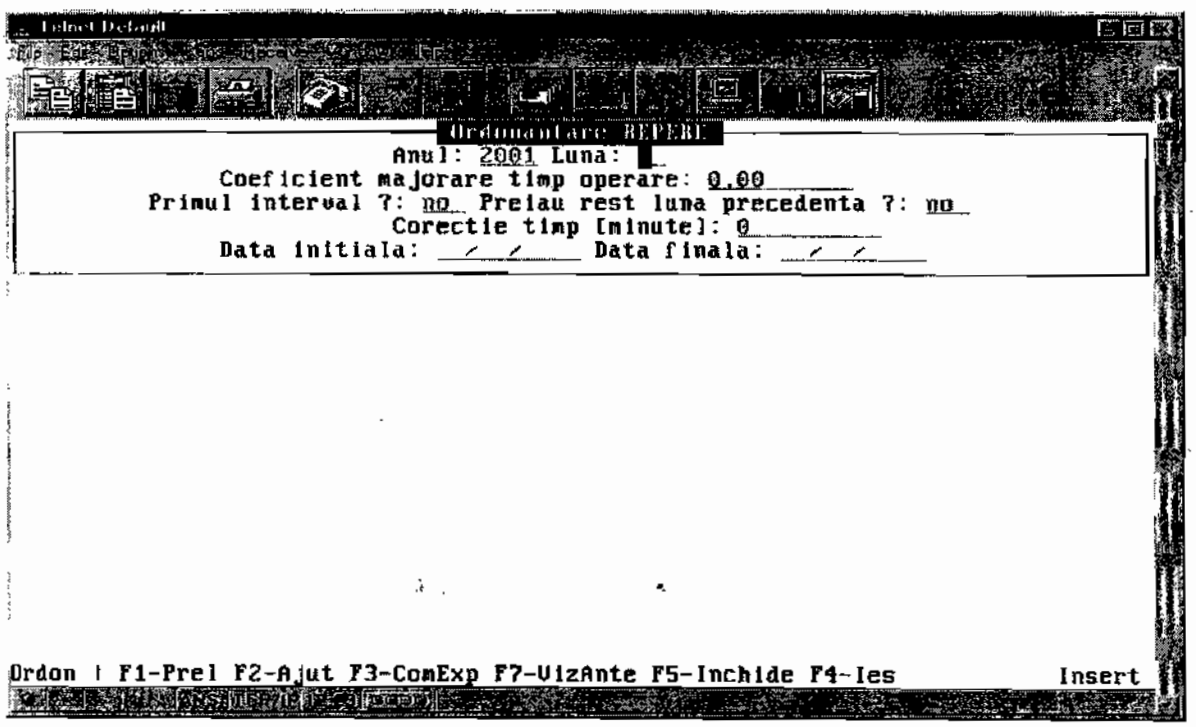
Ti – a time point in which the balance is done between scheduled quantities per month and achievements, the unachievements on the current month are written in the fields:

Qty_ramas_prod
Qty_ramas_exp

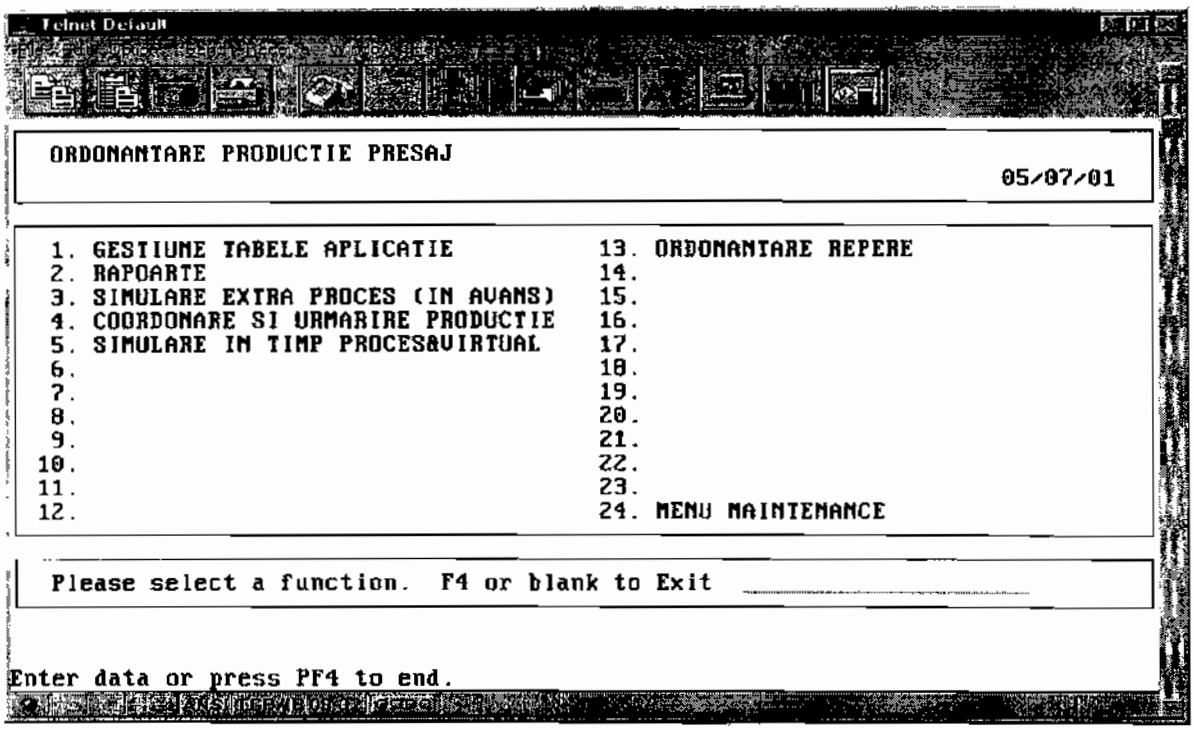
To be taken into account on the next month scheduling.

Application Presentation

If option 13 is selected, ITEM RELEASING, procedure oppmc818.p displays the screen below:



Time lens



The interval on which the time lens operates is specified by the two dates (d1, d2) from the screen below. The right limit of the interval represents also the maximum date (maximum achieved quantities) for critical section d1 - d2.

The normal usage cycle of the time lens (and also the critical section) is described below:

```
Lens 1(S1) Lens 2(S2) Lens 3(S3)  Lens 4(S4)
(----------)(----------)(----------)(----------)
1 2 3 4  ....                 20   ....   31
```

Thus, we have a representation of the time axis, with the days of the month and the intervals on which the program will be run chainly, the straight limits of the intervals on the period 1 ... 30/31 of month representing the maximum dates of the critical sections S1... Sn.

Input parameters:

- year: year on which the simulation is done;
- month: month on which the simulation (and the scheduling) is done;
- increasing coefficient of the operating time: usually, its value is 1.2, but it can also achieve other values (1, 1.5, ...); It allows the adjustment of the standard times, or the addition of delays, due to accidental breaks, taken in consideration anticipatedly;
- take the rest from previous month? : if "yes", the possible remained quantities to be manufactured from the previous month are taken into account for simulation (to be manufactured) within the current month;
- time correction (minutes): minutes introduced are evenly allotted on all the working days of the month, leading to increasing the final hour of the standard working day. If, from the monthly working schedule, there comes out an average final hour for the working day x, then, by using the correction, the final hour can be increased to x + y, where y = correction value / number of working days of the selected month.
- the initial date represents d1 date of the time lens;
- the final date represents d2 date of the time lens.

Once specified the input parameters, the command F1 can be run – that is the running of the releasing on the selected time lens.

Algorithm steps:

1) We add, if we take = "yes", quantities to be manufactured from the previuous month if there are, and we add them to the current month schedule (qty_plan, qty_prod_tot, qty_exp_tot);

2) There comes out a report of the items without acceptability rate (if such items exist); the quantities qty_exp_tot, qty_prod_tot, qty_ps, and qty_plan and their amount are increased, taking into account the acceptability rate of each item;

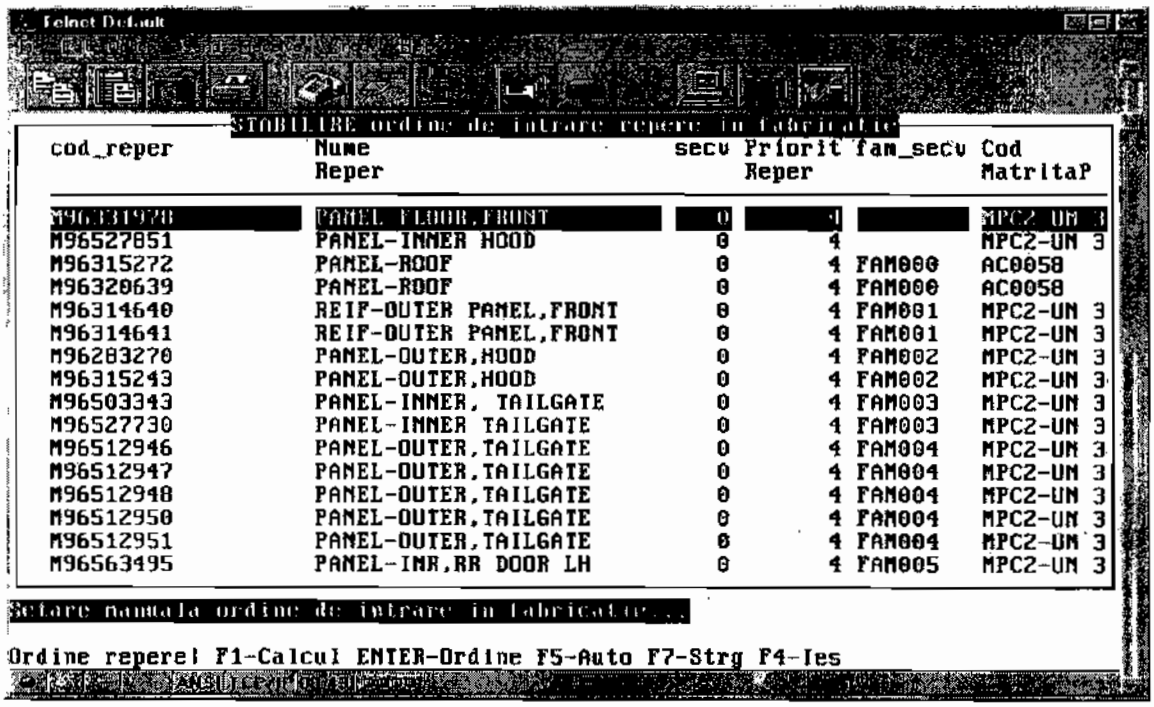
3) The daily quantities from the production schedule are increased with the acceptability rate (qty_prod_day[I]);

4) There comes out a report of the items that do not exist in the production sheets (if such items exist);

5) The production launching priorities are calculated for each item, from standard priorities table, for production, and for export, and the item is promoted on the highest priority obtained

6) The items are grouped in families, based on the die code which is used for the item manufacturing;

In this moment, you get the screen shown below:



A parenthesis: with the function F5, AUTO, we established "on automatic" the order of entrance in the production process. The use of this function is advisable, because the manual setting of the fabrication order raises further problems;

7) we calculate the quantities to launch for each item, on the current time lens:

Ql = plan + (optionally) previous month rest – achievements (export + production).

8) we calculate the maximum section (the scheduled quantities are cumulated planned for the production in the interval d1 – d2 of lens);

9) we calculate the average final hour of the working day;

10) we calculate the production time for the critical section quantities (Tr);

11) we calculate the available working time (+ correction, if correction is specified); be this time Td;

12) If Tr <= Td, then the available time assures the achieving of the critical section quantities (of maximum), and we also have an excedentary time budget, used for working and for "filling" the storage capacities, but only for those items which have an export schedule, so that they would not overpass the launched quantities;

Case I:

13) If Tr > Td, then the available working time does not assure the achievement of the critical section quantities, the manufactured items and the ones remained to be done are shown;

Case II:

Once reached this point, normally, one can try to increase the time correction, and to run the algorithm again;

Further on we present the algorithm used for each of the two cases:

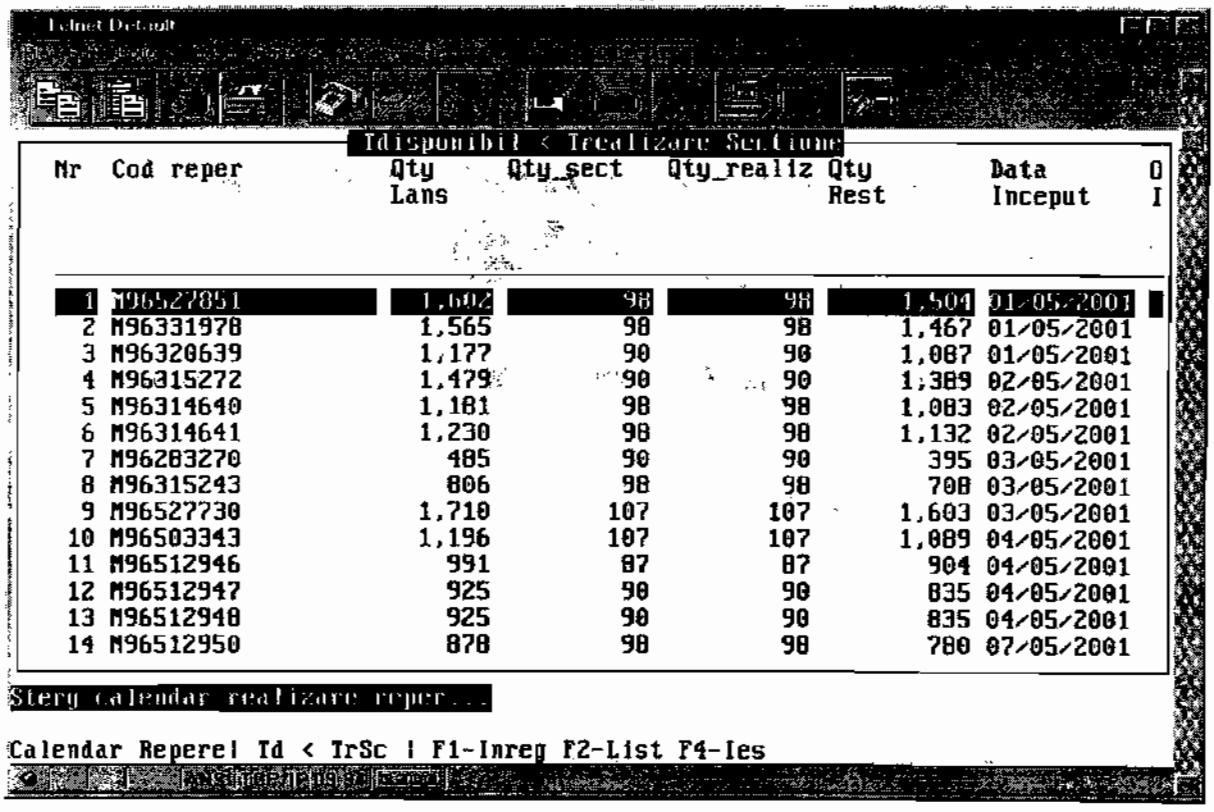
Case II: (Tr > Td)

a) We calculate the time to achieve the section;

b) We calculate the achievement schedule of the section items (schedule on days, hours and minutes of the quantities to be manufactured of each item);

c) We can see (and list) the achievement schedule for the items;

The screen below presents the report of the achievement schedule for the items in case II:



Telnet Default

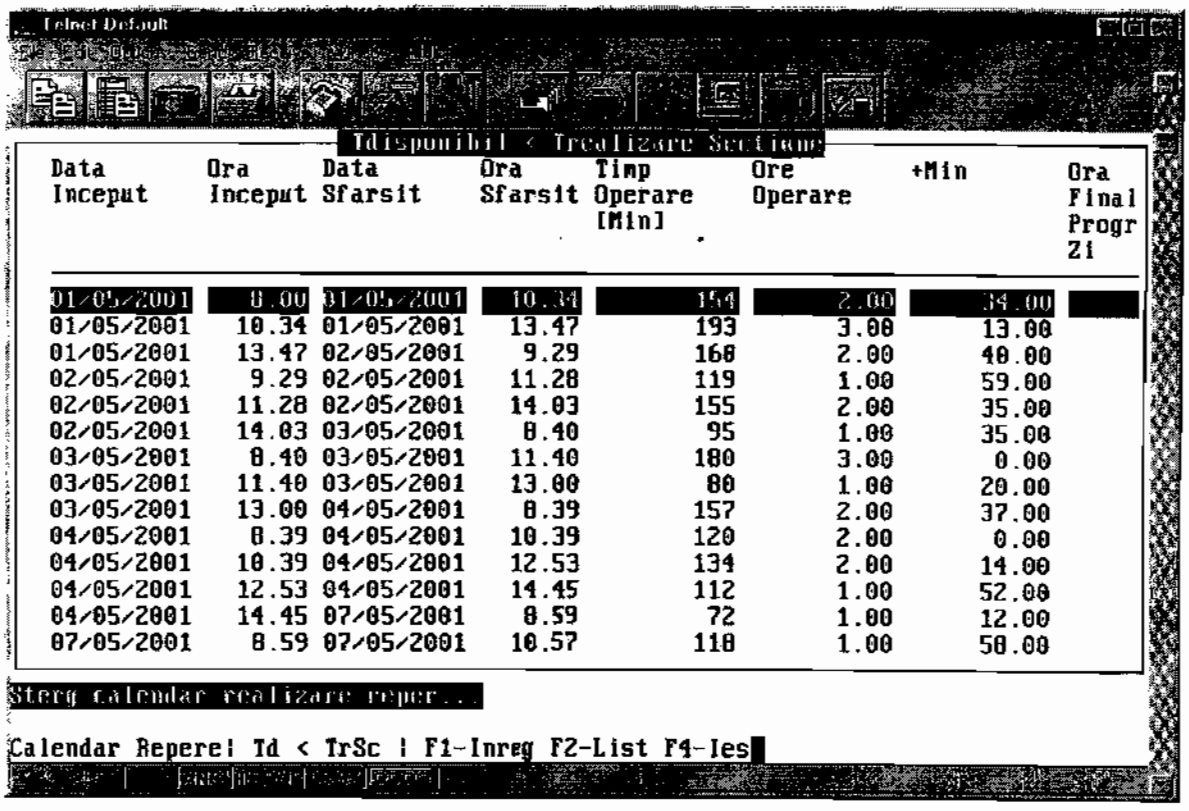
Idisponibil < Realizare Sectiune

Nr	Cod reper	Qty Lans	Qty_sect	Qty_realiz	Qty Rest	Data Inceput	O I
1	M96527851	1,602	98	98	1,504	01/05/2001	
2	M96331978	1,565	98	98	1,467	01/05/2001	
3	M96320639	1,177	90	90	1,087	01/05/2001	
4	M96315272	1,479	90	90	1,389	02/05/2001	
5	M96314640	1,181	98	98	1,083	02/05/2001	
6	M96314641	1,230	98	98	1,132	02/05/2001	
7	M96283270	485	90	90	395	03/05/2001	
8	M96315243	806	98	98	708	03/05/2001	
9	M96527730	1,710	107	107	1,603	03/05/2001	
10	M96503343	1,196	107	107	1,089	04/05/2001	
11	M96512946	991	87	87	904	04/05/2001	
12	M96512947	925	90	90	835	04/05/2001	
13	M96512948	925	90	90	835	04/05/2001	
14	M96512950	878	98	98	780	07/05/2001	

Sterg calendar realizare reper...

Calendar Repere! Id < IrSc ! F1-Inreg F2-List F4-Ies

The next screen, presented below, is obtained by horizontally moving the screen above, and it represents the achivement schedule of items on the specified duration:



Telnet Default

Idisponibil < Realizare Sectiune

Data Inceput	Ora Inceput	Data Sfarsit	Ora Sfarsit	Timp Operare [Min]	Ore Operare	+Min	Ora Final Progr Zi
01/05/2001	8.00	01/05/2001	10.34	154	2.00	34.00	
01/05/2001	10.34	01/05/2001	13.47	193	3.00	13.00	
01/05/2001	13.47	02/05/2001	9.29	168	2.00	40.00	
02/05/2001	9.29	02/05/2001	11.28	119	1.00	59.00	
02/05/2001	11.28	02/05/2001	14.03	155	2.00	35.00	
02/05/2001	14.03	03/05/2001	8.40	95	1.00	35.00	
03/05/2001	8.40	03/05/2001	11.40	180	3.00	0.00	
03/05/2001	11.40	03/05/2001	13.00	80	1.00	20.00	
03/05/2001	13.00	04/05/2001	8.39	157	2.00	37.00	
04/05/2001	8.39	04/05/2001	10.39	120	2.00	0.00	
04/05/2001	10.39	04/05/2001	12.53	134	2.00	14.00	
04/05/2001	12.53	04/05/2001	14.45	112	1.00	52.00	
04/05/2001	14.45	07/05/2001	8.59	72	1.00	12.00	
07/05/2001	8.59	07/05/2001	10.57	118	1.00	58.00	

Sterg calendar realizare reper...

Calendar Repere! Id < IrSc ! F1-Inreg F2-List F4-Ies

The beginning date, hour and minute quantities / item, date, hour and minute for finishing manufacture, and also manufacturing duration, in hours and minutes are emphasized.

Case 1. (Tr <= Td)

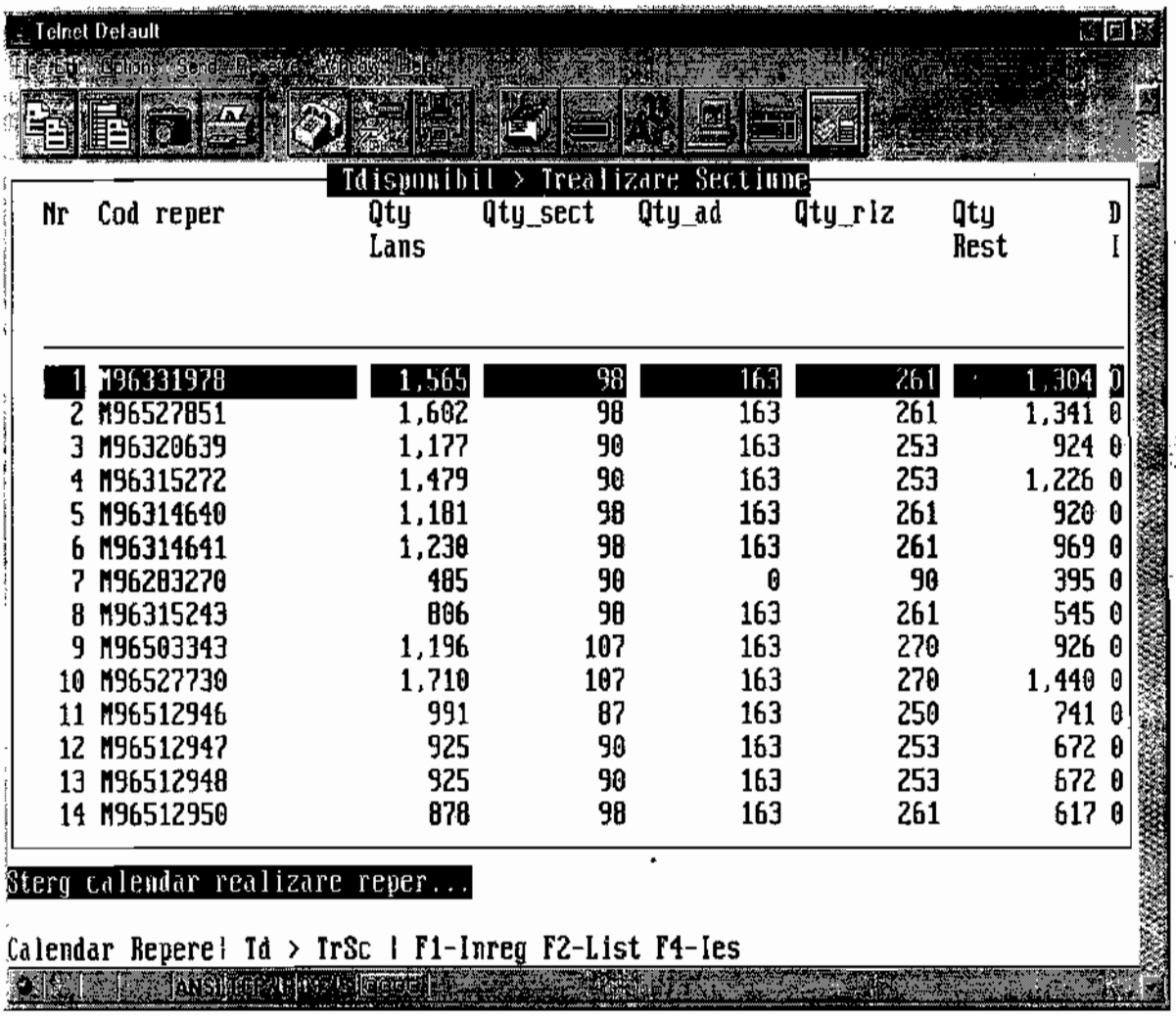
a) We calculate the time to achieve the section;

b) The current storage capacity is taken for each item of the section;

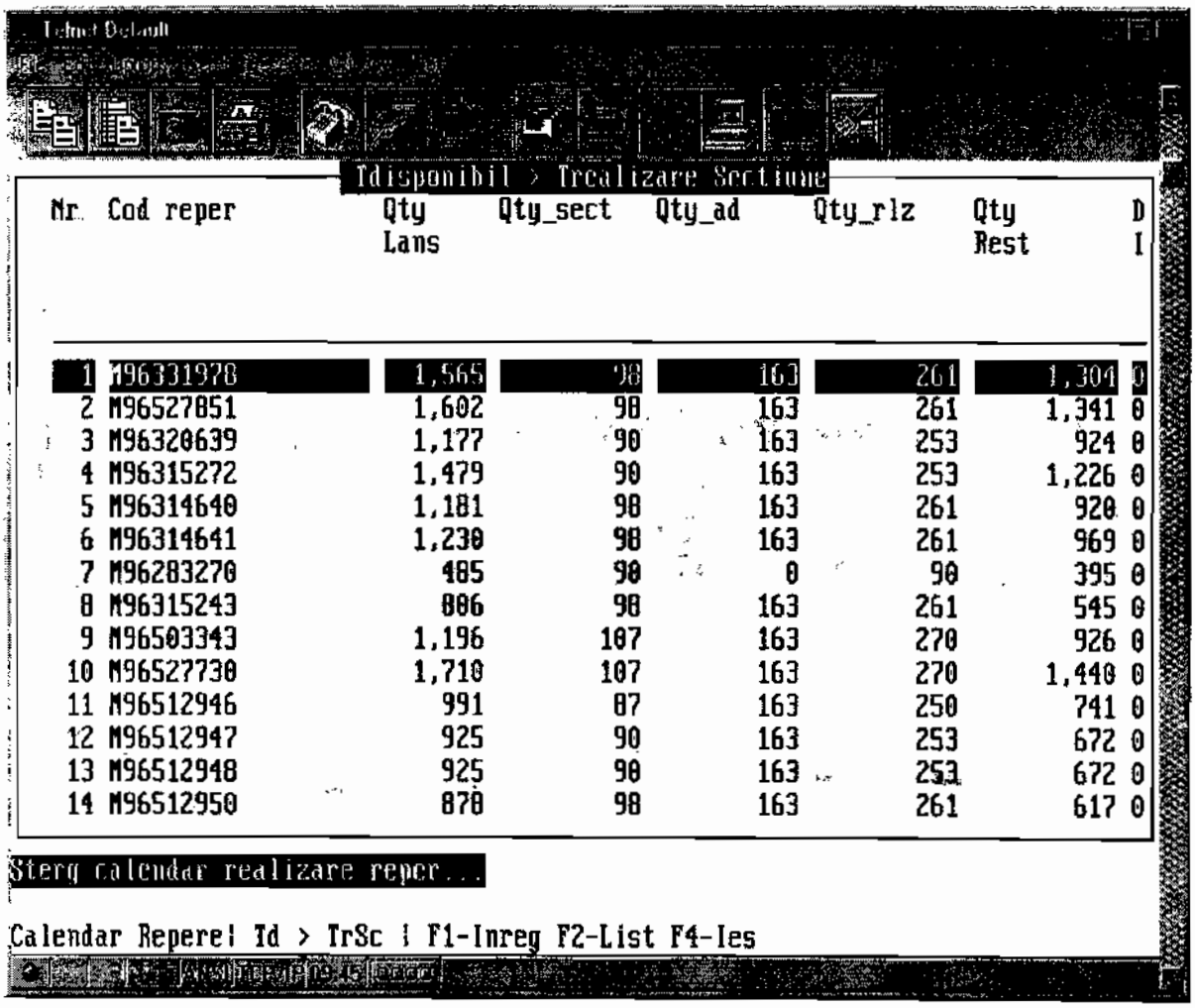
c) We redistribute evenly for all items the time difference between Td and Tr, but only for those with an export schedule, and we calculate the additional quantities achieved / item, with the limit of the available storage capacity;

d) We calculate the schedule of the item manufacturing;

e) We can see the item manufacturing schedule, obtaining the report from the screen below (quantities + times);



If the report is advanced horizontally, we can also see on the screen the manufacturing times schedule (see next screen).



Conclusions

1. We had as a request the comparative emphasis of the schedule with the production reported achievements globally but also on a daily basis. This means saving the simulation rezults for each lens in a file and establishing some comparative reports;

2. We had as a request the interference in planning (auto processing) and including of some time points of accidental immobilization. This involves in fact the introduction in the saved schedule of some fictitious items with "manufacturing" times = immobilization times and establishing a schedule correction module, which takes into account the delays imputed out-of-process like accidental breaks or lack of raw material.

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Ordonanţarea producţiei de piese de caroserie ambutisate

Rezumat

Articolul prezintă simularea unui program de producţie într-o secţie de presaj caroserii auto folosind teoria ordonanţării. Algoritmul de ordonanţare s-a efectuat pe o linie de prese H1 în intervalul de o lună calendaristică pentru calcul utilizând conceptul de secţiune critică, înţelegând prin acestea cantităţile totale q_i pentru fiecare reper R_i, care se regăsesc în componenta producţiei şi urmează a fi realizat.

Libérer de la production serrée de pièces de corps

Sommaire

L'article présent la simulation d'un programme de production dans un magasin de pression de corps de voiture en utilisant la théorie libérant. L'algorithme libérant a été examiné sur une ligne de pression pendant un mois, en utilisant pour des calculs le concept de section critique, comprenant par ceci tout le qi de quantités pour chaque article Ri, qui peut être recherché en composition en production et sera réalisé

***Mots-clés** : simulation, production, logiciel*