

# SCHEDULING<sup>+</sup> Ltd.

Company: **Scheduling Ltd.**

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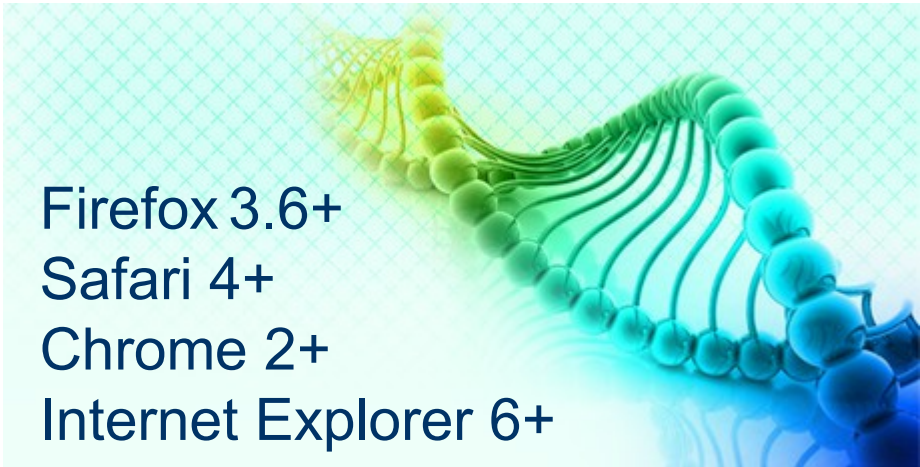
Email: [info@sledujplanuj.cz](mailto:info@sledujplanuj.cz)

Web: [www.sledujplanuj.cz](http://www.sledujplanuj.cz)

ID: 01610741



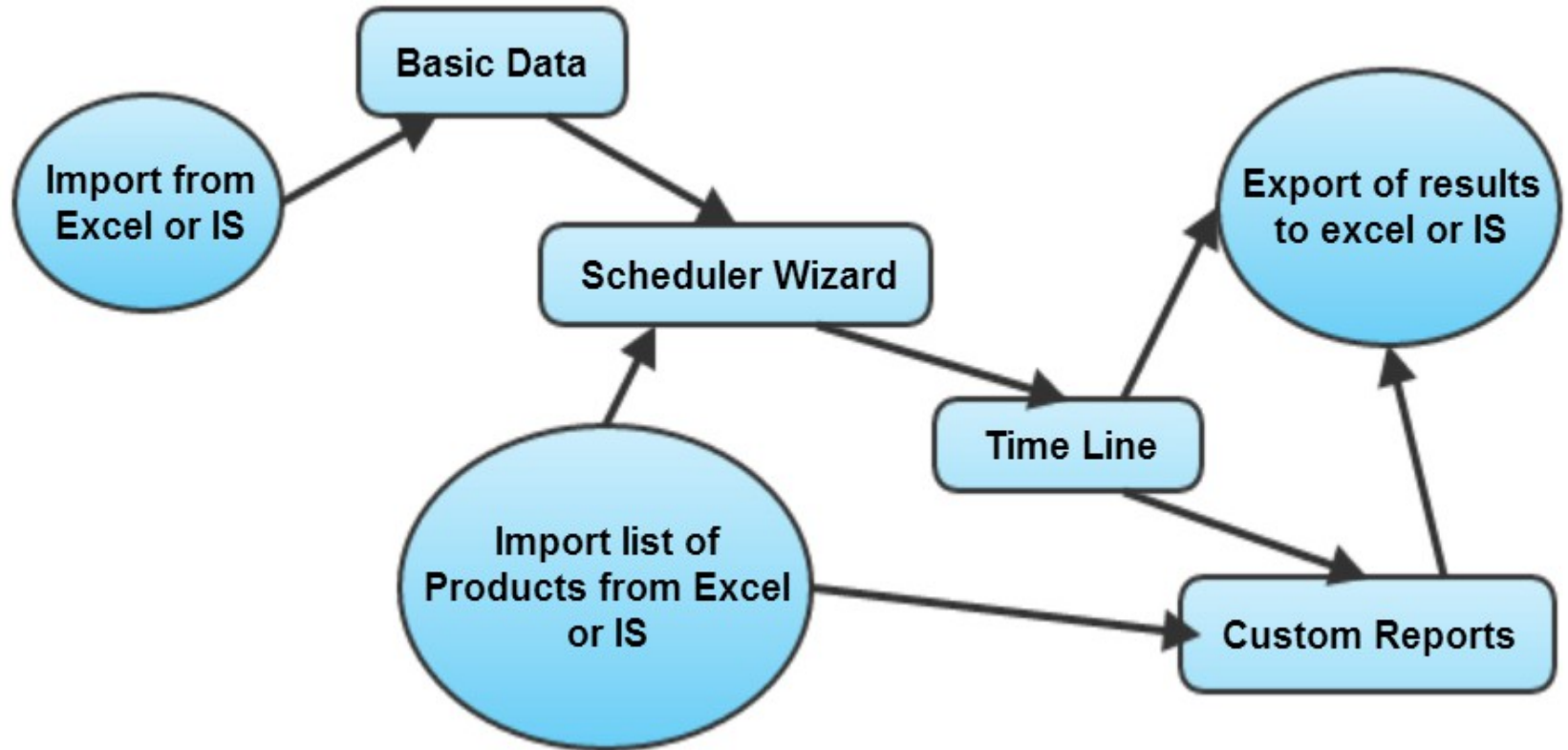
Resolution 1024x768 or higher



Firefox 3.6+  
Safari 4+  
Chrome 2+  
Internet Explorer 6+



# Software SMMIC



# The software usage

- 1 up to n machine – plastic production
- Sortiment of 1 up to n products
- continuous or partial operation (traffic exchange)
- holidays, weekends, days off
- changes in the plans
- number of people in production

# Adjustable conditions

- Priority of individual contracts - according to the importance of the customer or contract
- Suitability mold for different types of machines
- Deadlines
- Additional times (cast molds, machine cleaning, maintenance..)
- Type of operation - the number of people needed to operate
- Material
  - Type of material
  - The color of the material
- Possibility pair products / contracts on the same form
- Option to specify the average number of people in manufacturing
- Set the number of setters

# Implementation of planning

- **Plan** → sequence of tasks assigned to individual machines (contract number. 3,5,8,9,22, ...)

Calculation of all solutions

- 100 operations → all permutations  $100!$  →  $9.3326215443944E+157$  of all options
- 1 schedule → calculation time around 26 ms
- total calculation time →  $2.94E+146$  years

Heuristic methods

- **Fitness (The evaluation function)** → plan evaluated based on defined conditions

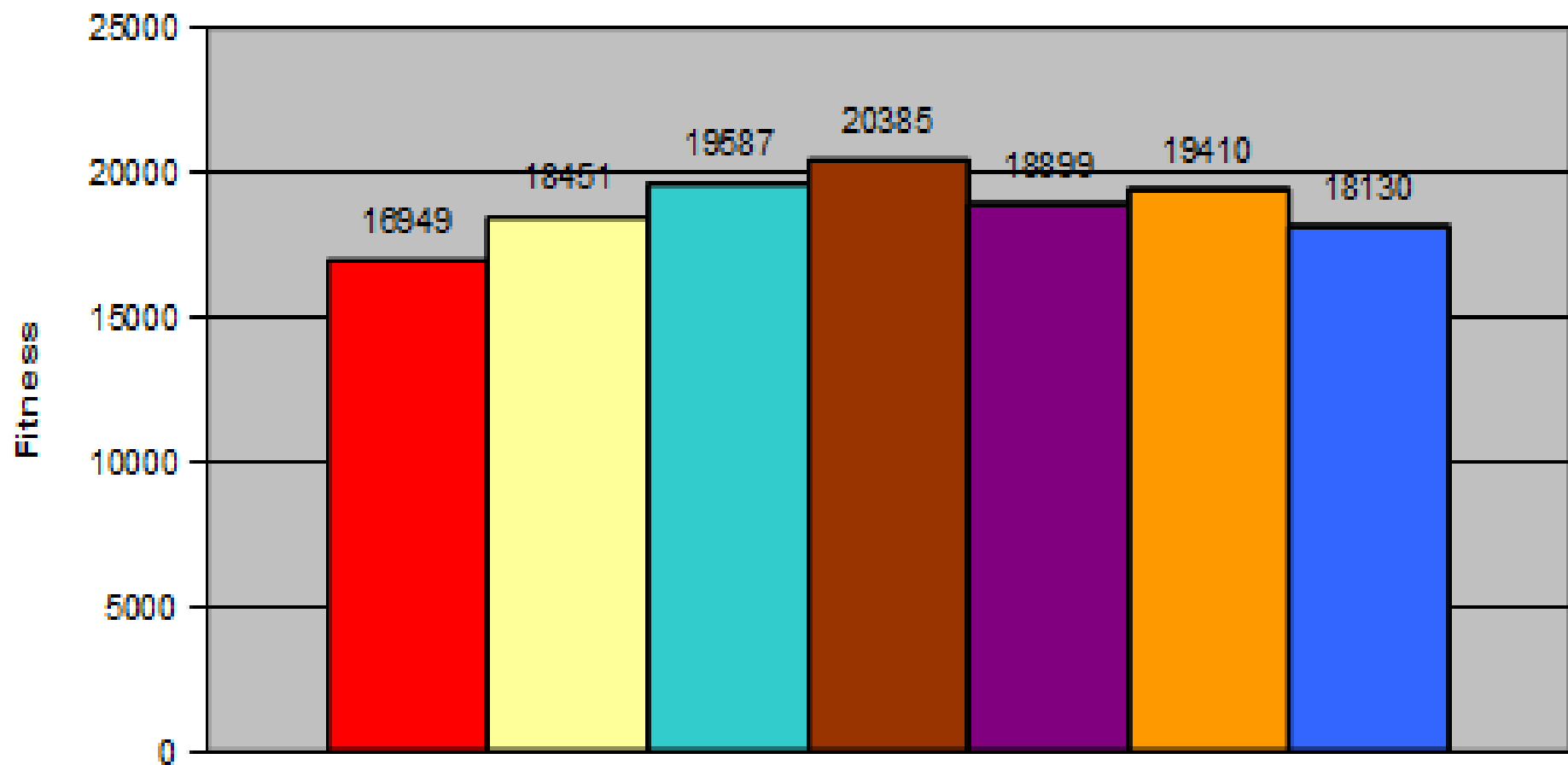
# Heuristic methods

- Local search
- Tabu search
- Simulated annealing
- Genetic algorithms

# Výsledky fitness funkcí jednotlivých heuristických metod a jejich srovnání s ručně sestaveným plány

built by hand [-]	Iteration 100, population 400 [-]	quality compare [%]	Time [min]	Iteration 400, Population 1000 [-]	quality compare [%]	Time [min]	Iteration 800, Population 1000 [-]	quality compare [%]	Time [min]	Number of Jobs
18474	21186	14,7	5	22652	22,6	60	22850	23,7	91	143
16950	18650	10,0	5	19356	14,2	55	19455	14,8	103	145
21937	21986	0,2	5	23684	8,0	63	25737	17,3	98	154
15564	17195	10,5	4	17871	14,8	52	19460	25,0	86	137
11821	13237	12,0	3	14373	21,6	35	14421	22,0	52	96
16949	18451	9	4	19587	16	53	20385	21	86	135
built by hand [-]	Local Search 1000 [-]	quality compare [%]	Iteration Count [-]	Tabu Search Iteration 400, Population 1000, tabu 25 [-]	quality compare [%]	Time [min]	simulated annealing /Temperature 50 - 1500/kma x 1000/alfa 0.99 [-]	quality compare [%]	Time [min]	Number of Jobs
18474	21929	18,7	117	21344	15,5	21	20488	10,9	20	143
16950	18462	8,9	78	19415	14,5	21	16918	-0,2	21	145
21937	23340	6,4	91	23973	9,3	23	22666	3,3	22	154
15564	17197	10,5	75	18171	16,8	19	18158	16,7	20	137
11821	13567	14,8	54	14149	19,7	14	12422	14,0	14	96
16949	18899	12	83	19410	15	20	18130	9	19	135





■ 16949

■ 18451

■ 19587

■ 20385

■ 18899

■ 19410

■ 18130

# Conclusion

- **Genetic algorithms** –increase the quality of 21%
- **Others used heuristic methods** – increase the quality of *10 up to 15 %*