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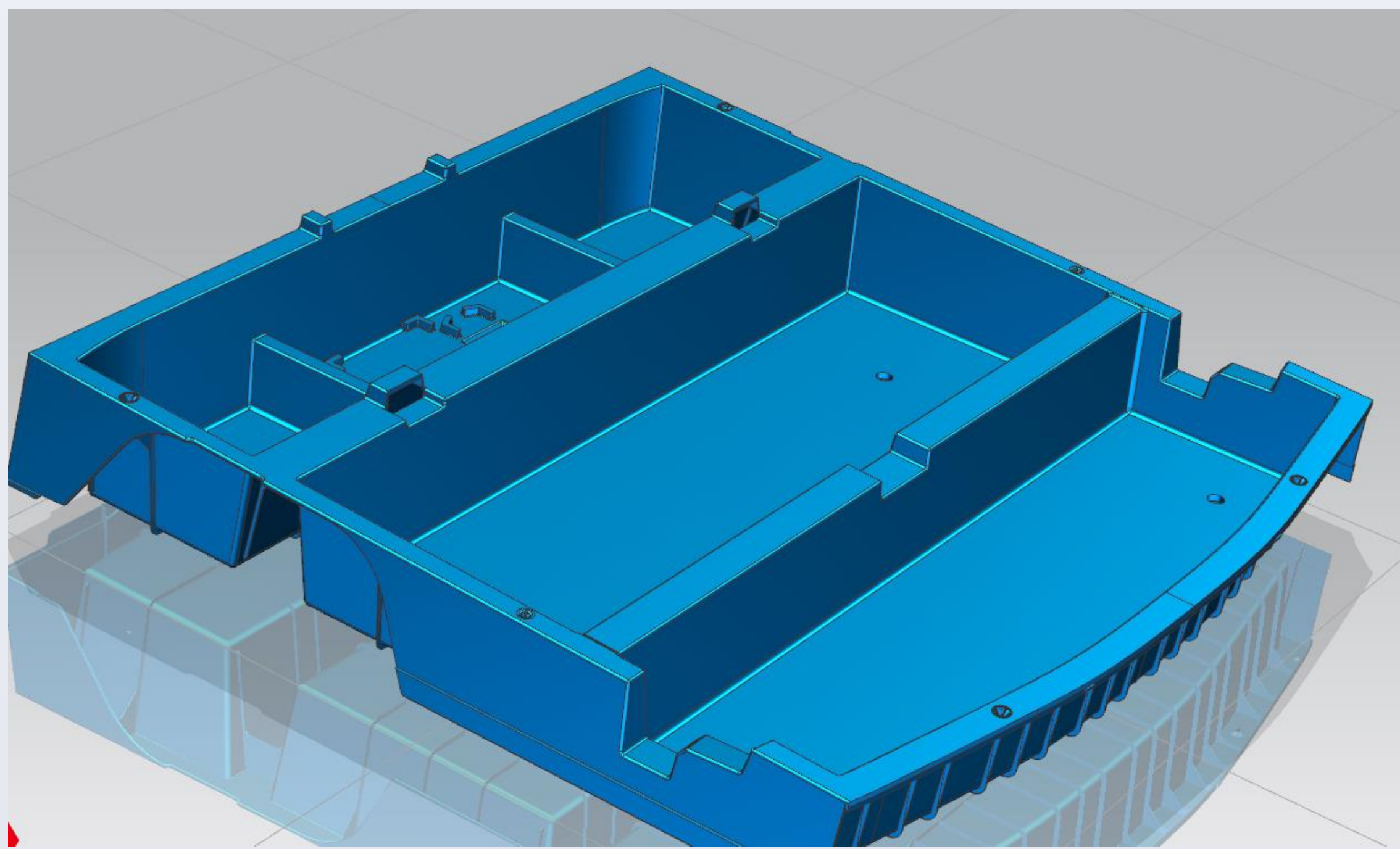
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## Company Advisor(s)

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**OBJECTIVE**

Our objective is to minimize the project duration of mold manufacturing process by considering precedence relations between tasks and the resource capacities of the factory.

**KAREL KALIP**

Karel Kalıp is a mold manufacturer for the automotive industry with an active R&D center. Mold design is a complex process which involves roughly 1200 components. At Karel Kalıp, these components are partially manufactured in-house, partially purchased, and partially subcontracted.

**OUR MATHEMATICAL MODEL**

$\bullet X_{ikt} = 1$  if the task  $i$  finishes at time  $t$  and uses resource  $k$   
0 elsewhere

$$\text{Minimize } \sum_{t=EFT_i}^{LFT_i} t \cdot x_{nkt}$$

s.t.

$$\sum_{k=1}^m \sum_{t=EFT_i}^{LFT_i} x_{ikt} = 1 ;$$

for  $i=1, \dots, n$

$$\sum_{k=1}^m \sum_{t=EFT_i}^{LFT_i} t \cdot x_{ikt} \leq \sum_{t=EFT_j}^{LFT_j} t \cdot x_{jkt} - d_j,$$

for all  $(i,j) \in A$

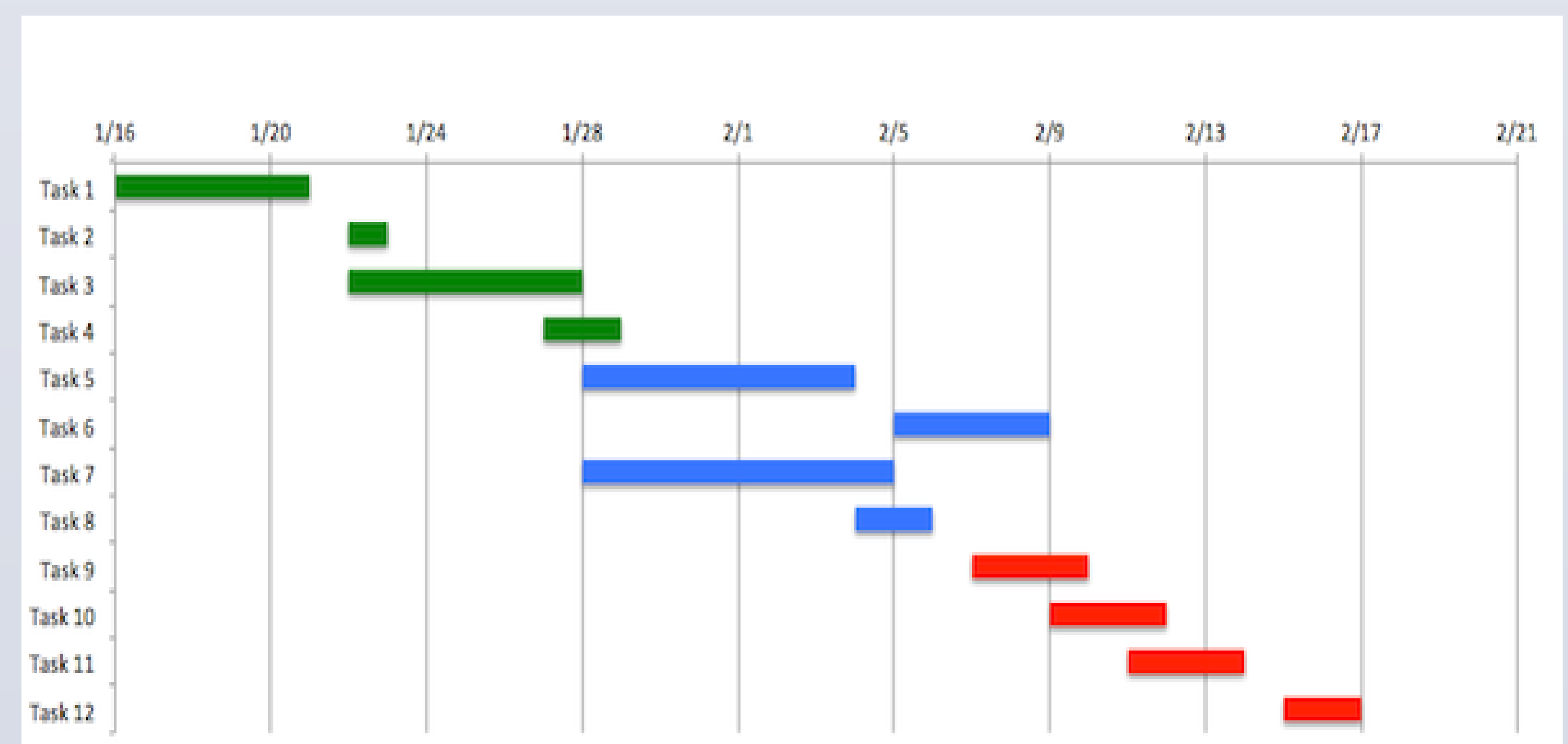
$$\sum_{i=1}^n \sum_{q=\max\{t, EFT_i\}}^{\min\{t+d_j-1, LFT_i\}} r_{ik} \cdot x_{ikq} \leq a_k ;$$

For  $k=1, \dots, m, t=1, \dots, T$

$$X_{it} \in \{0,1\} \quad \text{for } i=1, \dots, n \text{ and } t=EFT_i \dots LFT_i$$

**STEPS OF ANALYSIS,  
DESIGN, IMPLEMENTATION**

- Meetings with the stakeholders at Karel Kalıp
- Definition of problem
- Data collection
- Methodology research
- Creation of a benchmark using MS Project
- Development of an integer programming model for project scheduling.
- Implementation in IBM ILOG CPLEX Optimization Studio
- Implementation in Python via CPLEX APIs and applying the CPM Method
- Output of the optimal schedule
- Assignment of tasks to resources over time
- Gantt chart output
- Analysis and comparison of results

**RESULT****CONCLUSION**

At the end of this project, our aim is to minimize the make span of the mold manufacturing process in order to determine the optimal schedule of the design process of mold manufacturing by using the output of our mathematical model for manufacturing process.