Optimizing a Business Process Model by Using Simulation

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Outline

- Introduction and problem definition
- A Model for estimating performance of a Process
- Type of processes
- Suggested optimization algorithms
- Conclusions and future work

What is Performance of an Organization?

- There is no universal approach.
- The ultimate measure of performance is to what degree the desired effects are achieved.
- Performance improvement is a holistic and long-term approach.

Possible Improvements Methods

- Employing qualified personnel
- Improving capabilities of personnel with education and training
- Optimizing the Work process and the structure of the organization
- Assigning tasks to employees best qualified for performing them

Simplifying Factors

- Resources are generally qualified (in some degree) for all activities in the process
- Non-time-critical tasks
- Budget is not a constraint

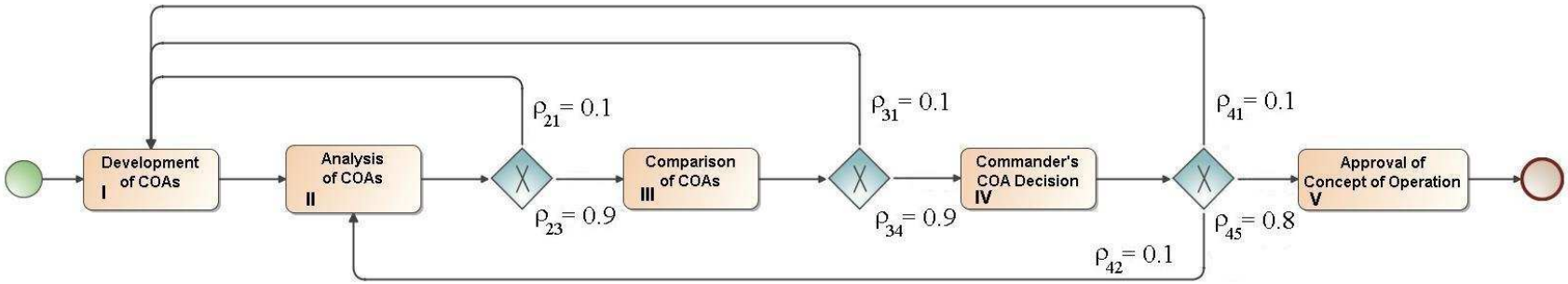
Problem Definition

- tasks $\mathbb{T} = \{t_1, \ldots, t_n\}$
- agents $\mathbb{A} = \{a_1, \ldots, a_m\}$
- a gain model $v : \{\mathbb{T} \times \mathbb{A}\} \curvearrowright \mathbb{R}$
- a Business Process Model *BPM*
- constraint: each agent performs only one task
- Find: the optimal assignment of tasks to agents

Performance of a Process

- $v : \{\mathbb{T} \times \mathbb{A}\} \curvearrowright \mathbb{R}$ defines the Matrix $\mathbb{V} = [v_{ij}]_{m \times n}$
- Number of times each Task is performed (x_j)
- The impact of each Task on the Process (q_j)
- The Assignment Matrix $\mathbb{Z} = [z_{ij}]_{m \times n}$ if Task j is assigned to Agent i then $z_{ij} = 1$ and 0 otherwise.
- $u = \sum_{j=1}^{n} x_j q_j \sum_{i=1}^{m} v_{ij} z_{ij}$.

Operational Planning



Operational Planning Concept Development expressed in BPMN, extended by the probability of branches.

Different Types of Processes

- Deterministic Processes
- Markovian Processes
- Non-Markovian Processes
- Assignment Depended Processes

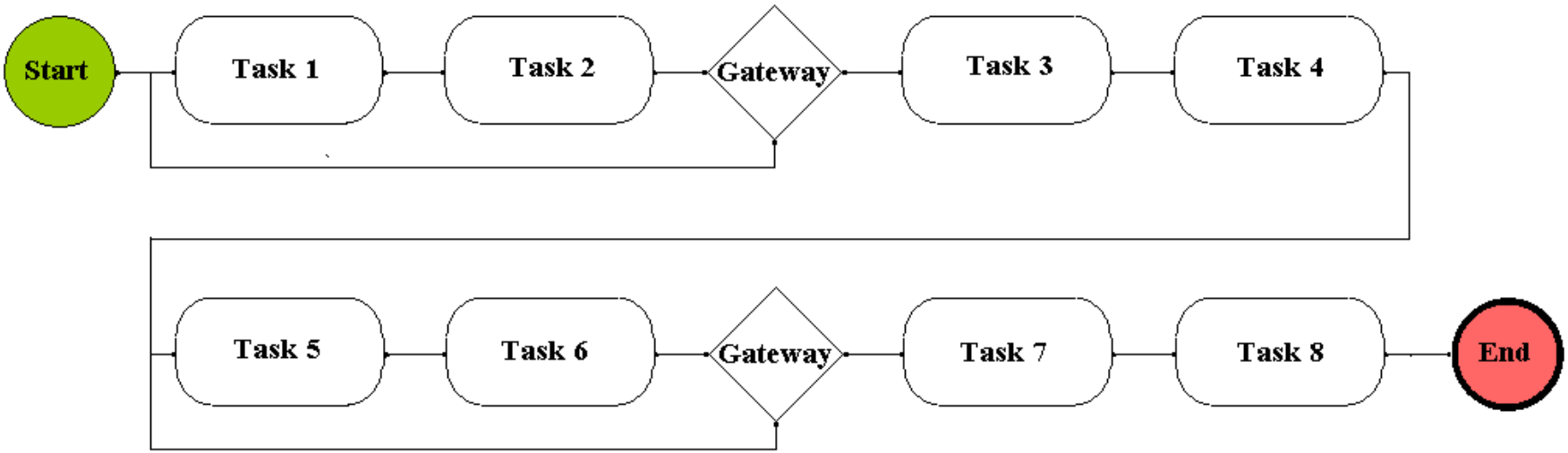
Types of Processes: Optimization Methods

- Deterministic Processes: Hungarian Algorithm
- Markovian Processes: Analytical Solution & Hungarian Algorithm
- Non-Markovian Processes: Simulation & Hungarian Algorithm
- Assignment Depended Processes: Repeated Simulation & Hungarian Algorithm

Assignment Depended Processes

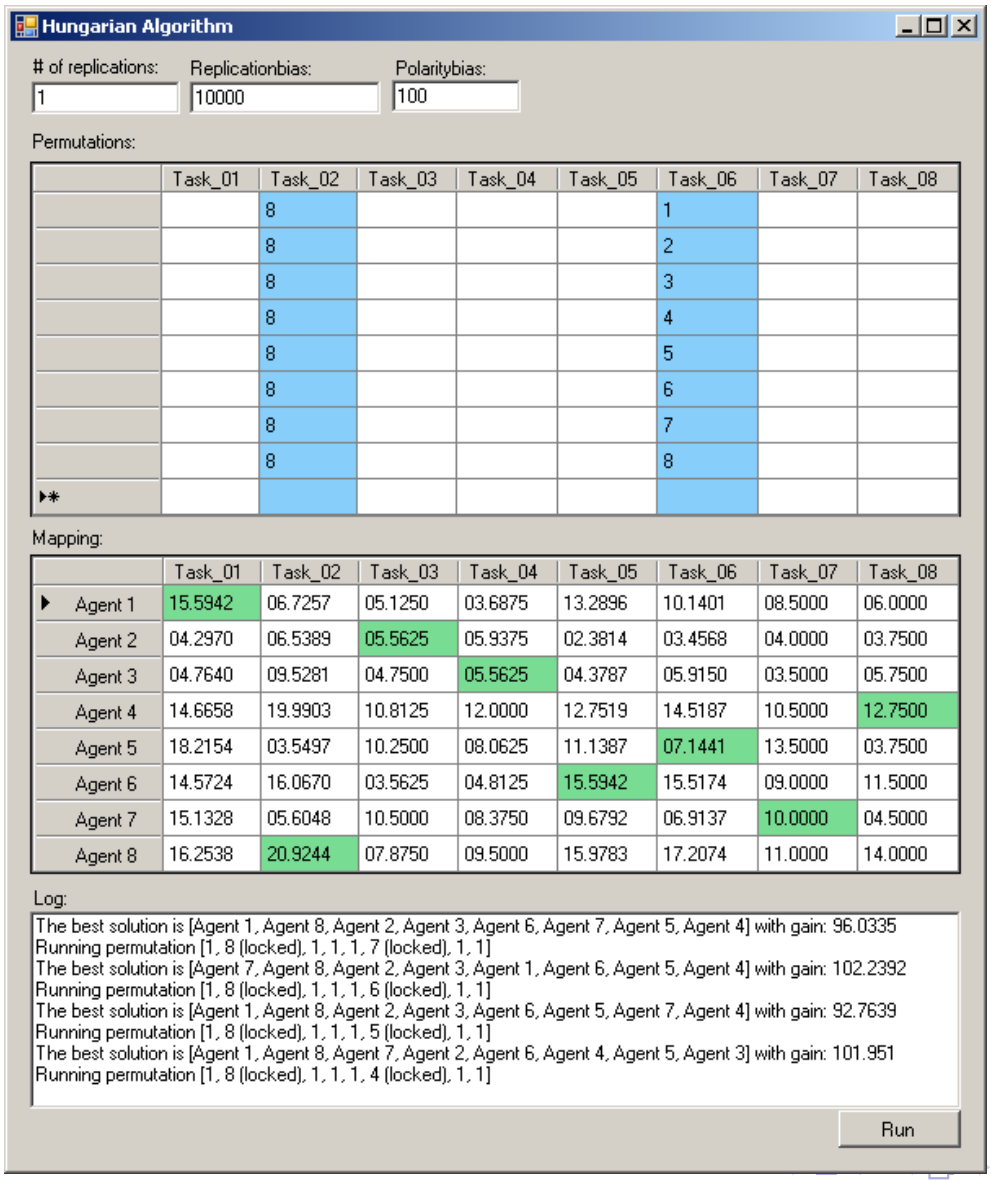
- Critical Tasks / Non-Critical Tasks
- Finding optimal solution for non-critical Tasks using simulation and Hungarian algorithm
- Finding a near-optimal solution for critical Tasks using simulation and Hill-Climbing

BPMN Model in Arena

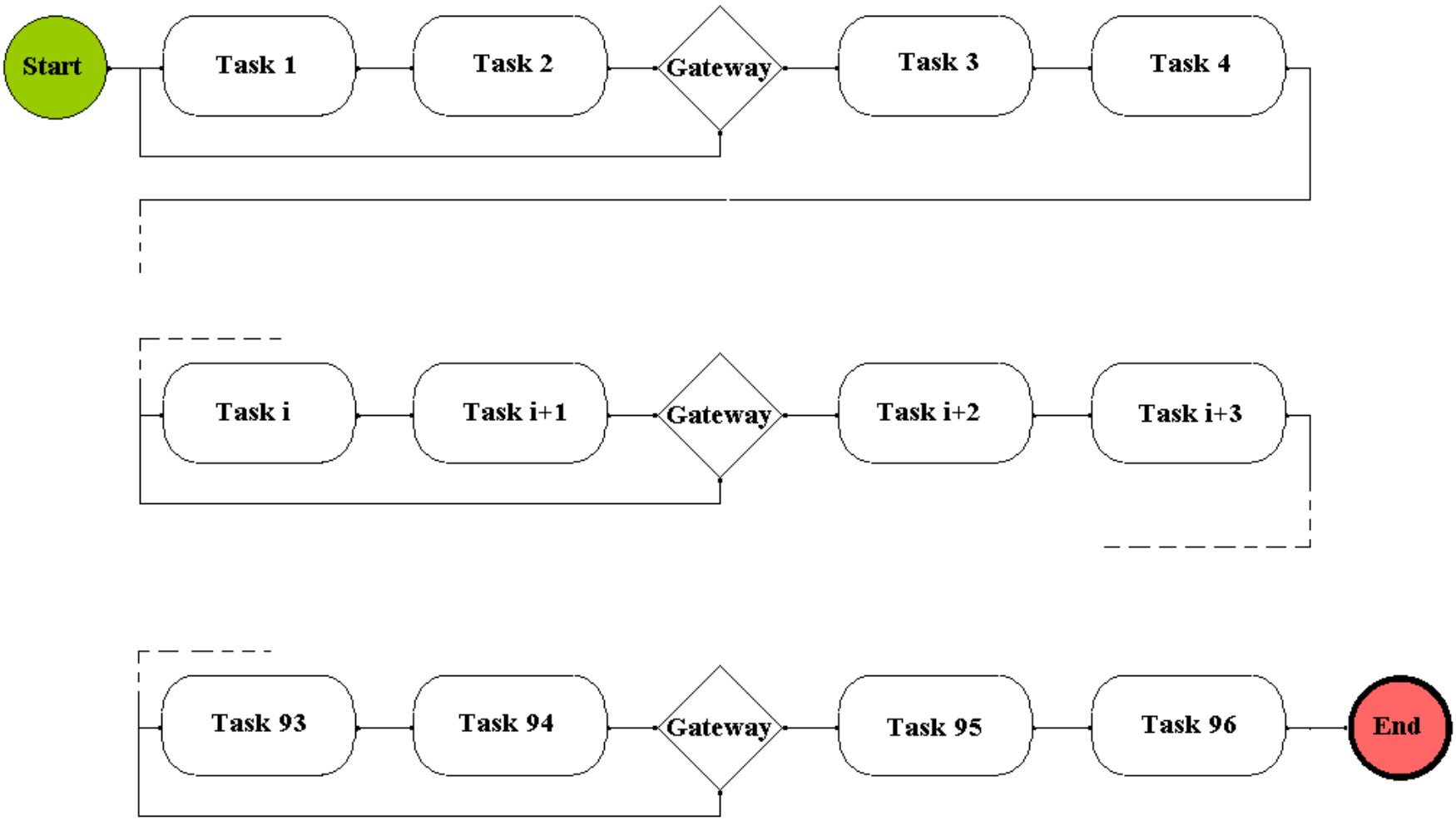


Test Model with 16 tasks for Non-Markovian processes.

Optimizer Application



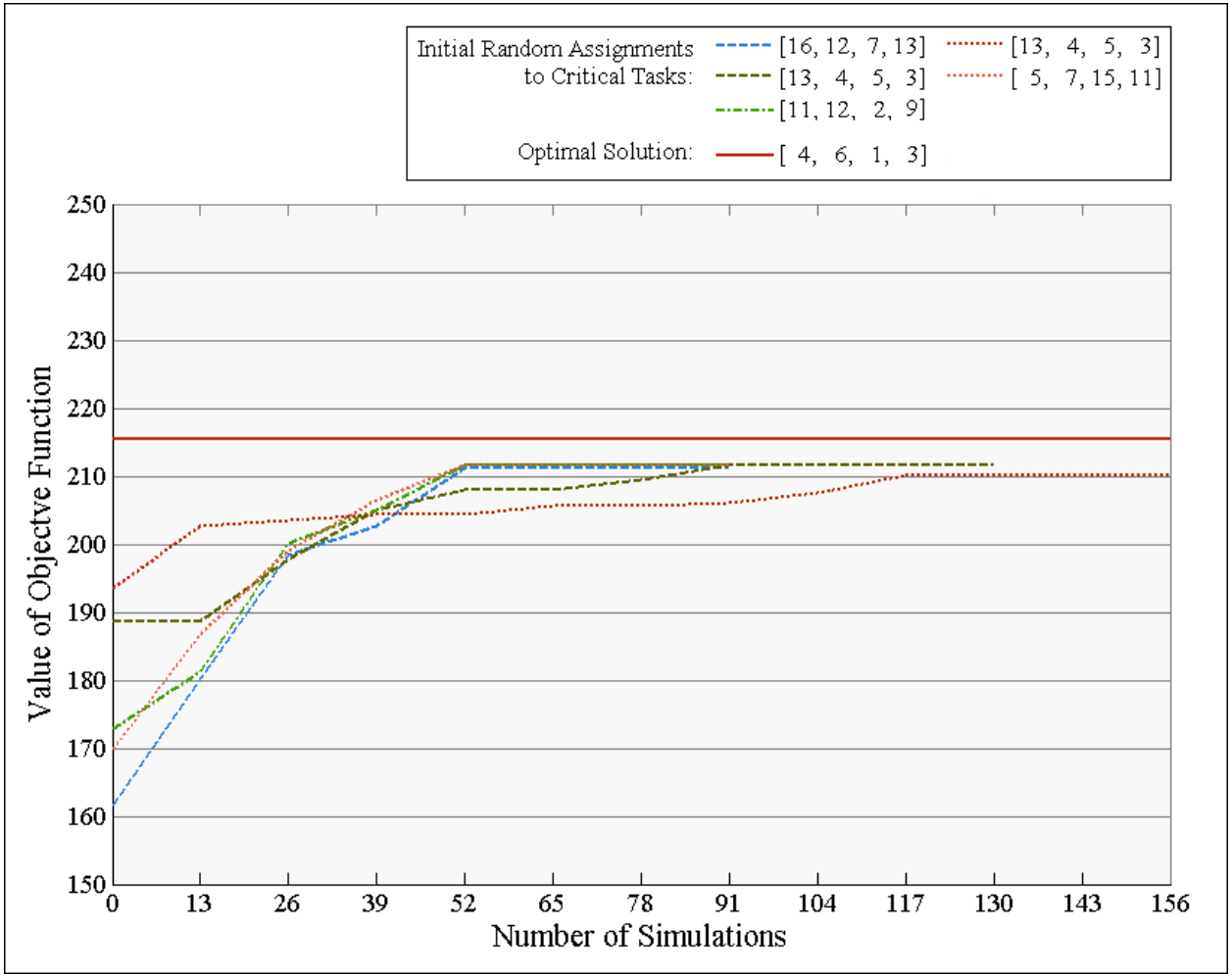
BPMN Model in Arena



Results for Algorithm 2

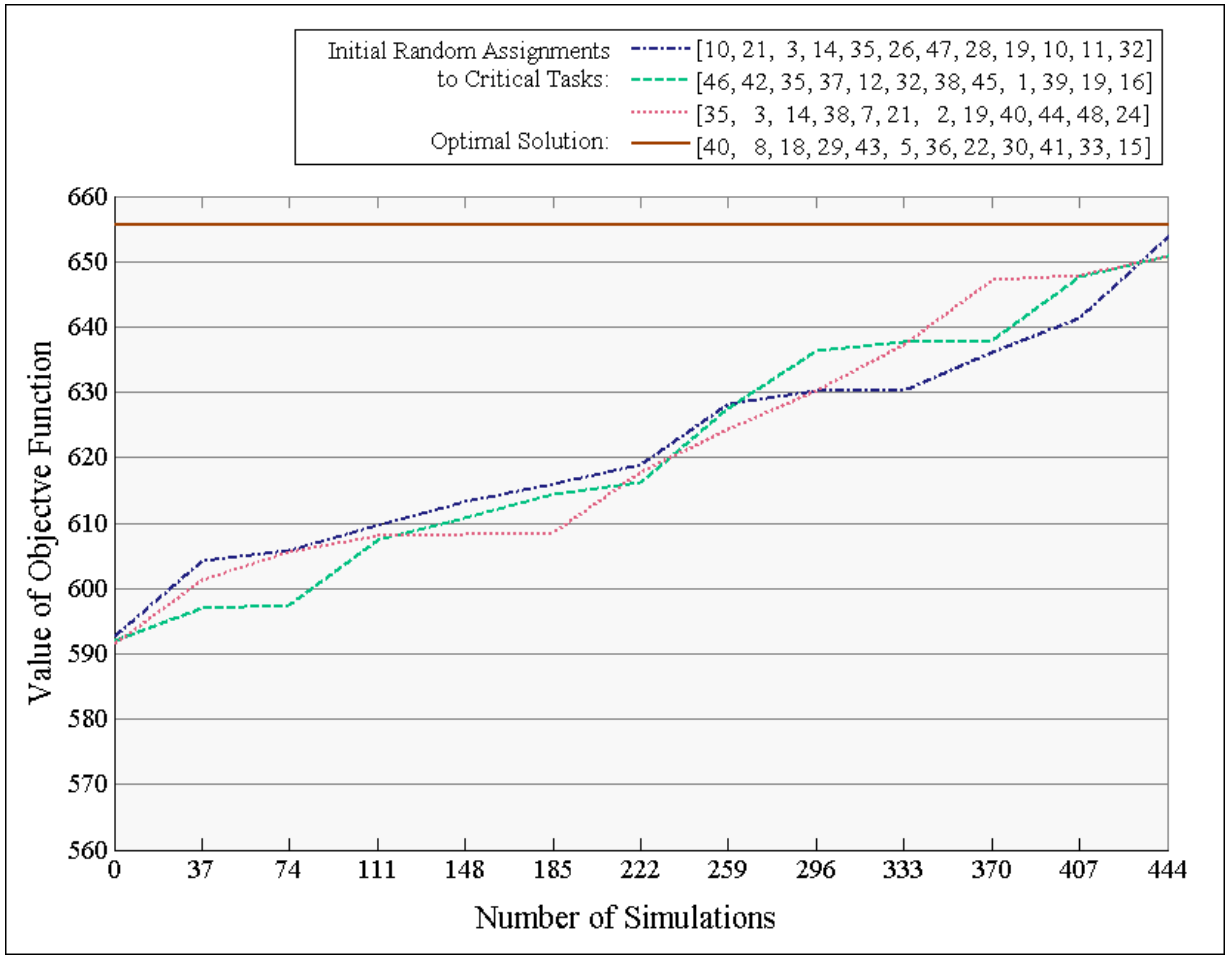
Size	Min Gain	Max Gain	Nr. of Combinations
8	46.80	103.71	4.03×10^{4}
16	93.70	213.53	2.09×10^{13}
24	124.34	323.13	6.20×10^{23}
32	162.25	435.38	2.63×10^{35}
40	203.30	554.92	8.16×10^{47}
48	249.52	655.53	1.24×10^{61}
56	298.37	775.47	7.11×10^{74}
64	327.25	882.18	1.27×10^{89}
72	393.78	1016.79	6.12×10^{103}
80	451.29	1137.24	7.16×10^{118}
88	506.57	1256.00	1.85×10^{134}
96	556.60	1385.57	9.92×10^{149}

Results of Algorithm 4



Results of Algorithm 4 for 16 tasks

Results of Algorithm 4



Results of Algorithm 4 for 48 tasks

Conclusion and Future Work

- Given a model for performance of an agent we suggested a method for estimating the performance of a Business Process by aggregating performances of Tasks and considering uncertainty of the flow of the Business Process
- The most general case is non-Markovian, assignment dependent process
- a method based on partitioning the process into critical and non-critical Tasks yields a near-optimal solution in reasonable time
- Future Work: Modeling and including team working in estimating the performance of Agents

Thank You!