

# AN APPLICATION FOR SCHEDULING TASK ASSIGNMENTS IN THE ANIMATION INDUSTRY

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Department of Industrial Engineering

December 6, 2022

CUT TO:

3

INT. APARTMENT 6C - DAY

3

We enter through an open window to see

A CHUBBY MAN

in a food spattered t-shirt. He is sitting hunched over a bowl of gaspacho soup, slurping. *S.O.*

Music -  
Cartoon

He pauses, the spoon half way to his mouth. His eyes follow SOMETHING crawling on the table in front of him.

He puts his spoon down and crosses to an intercom on the far wall. He presses a button. Through the receiver we HEAR the constant and annoying BLEAT of a buzzer.

Chubby waddles back to the table still clutching the receiver and resumes slurping his soup. In between the slurps we can hear the BLEAT of the buzzer.

Slurp. BLEAT. Slurp. BLEAT.

one fluid  
shot

SOUND: Scurrying

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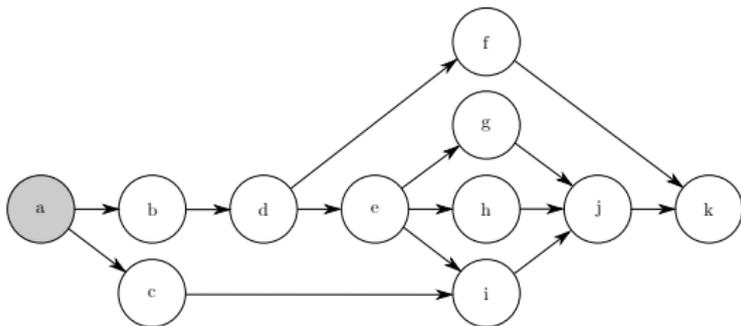
CUT TO:

3

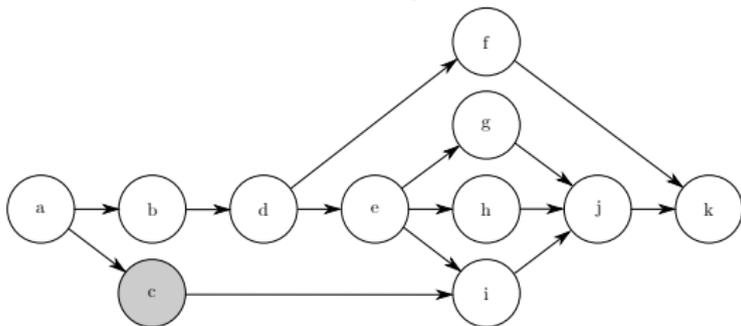
Music-Cartoon

one fluid shot

SOUND: Scurrying



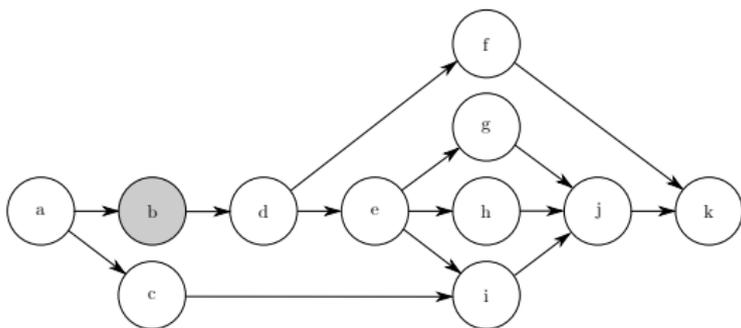
# Story Boarding



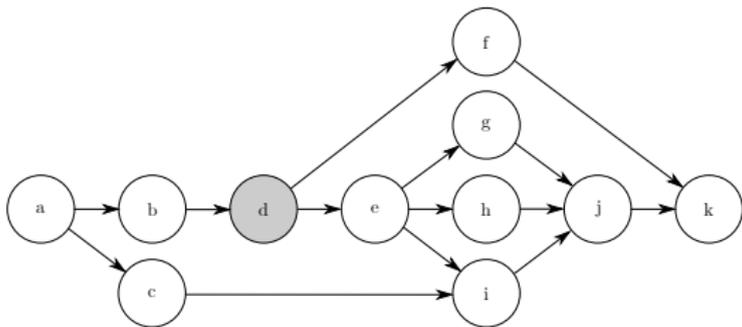
# 2D Model Sheet



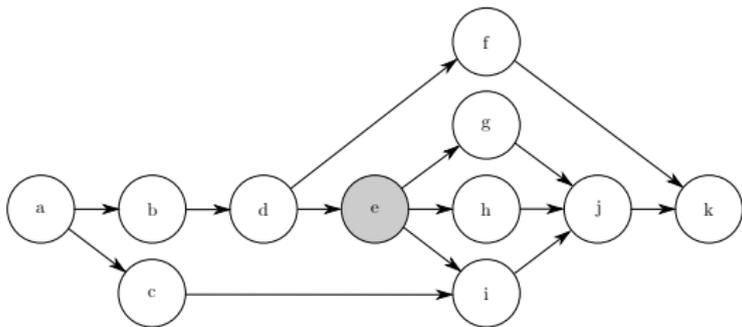
ARTIST LORENZO SABIA / CHARACTER DESIGNER EDGAR



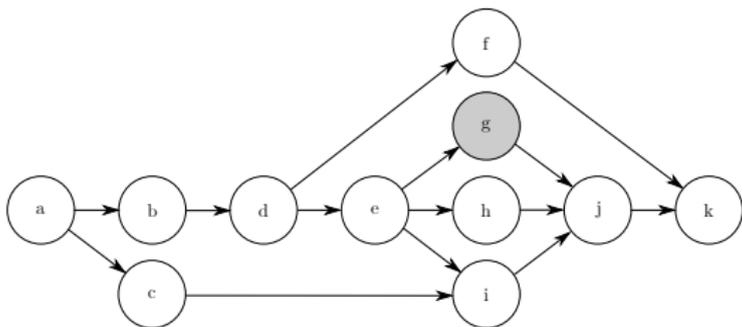
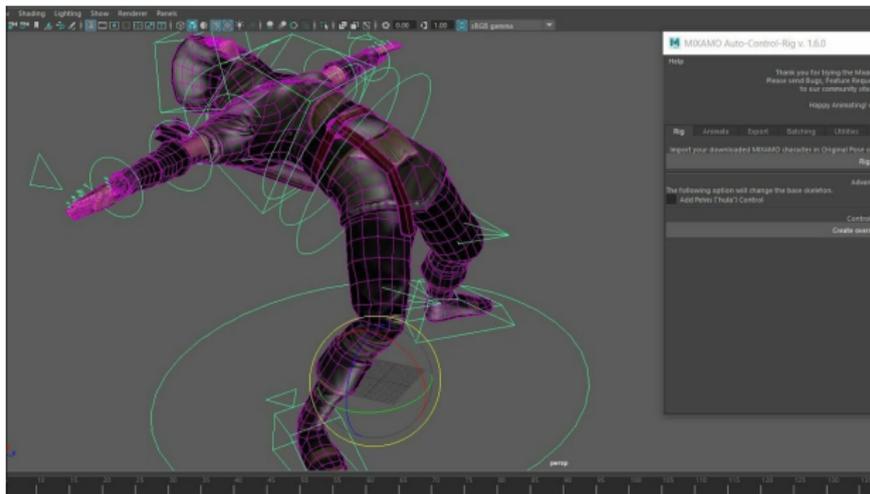
# 3D Model Sheet



# Preliminary Rig



# Rig Testing

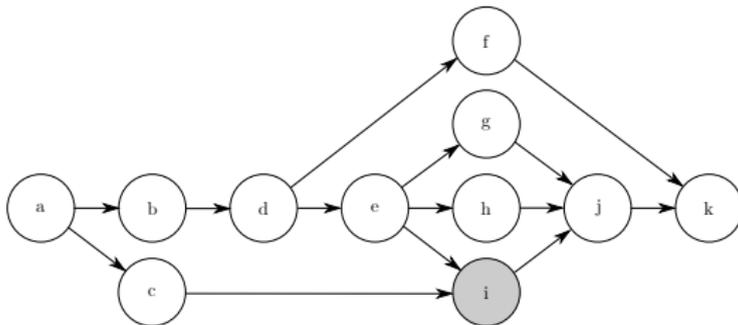




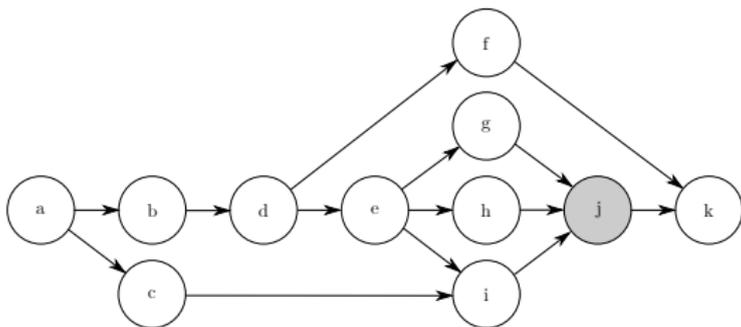
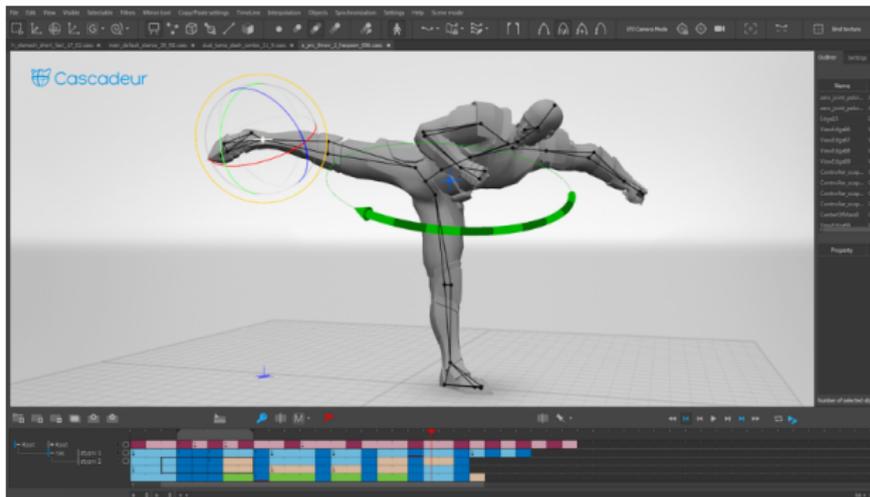
# Layout



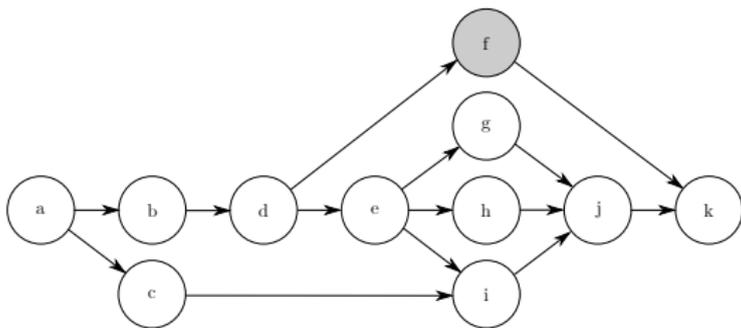
"MONSTERS UNIVERSITY" Progression Image 4 of 6: LAYOUT  
©2013 Disney•Pixar. All Rights Reserved.



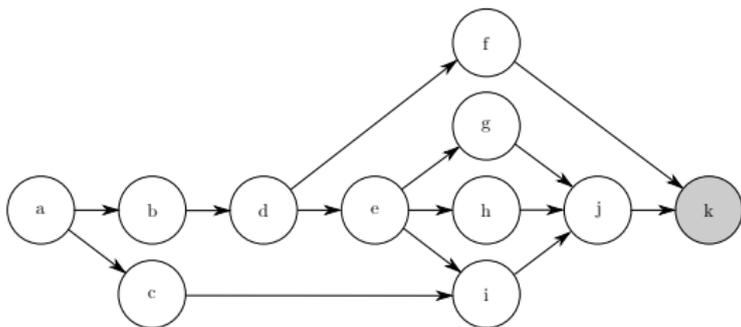
# Animation



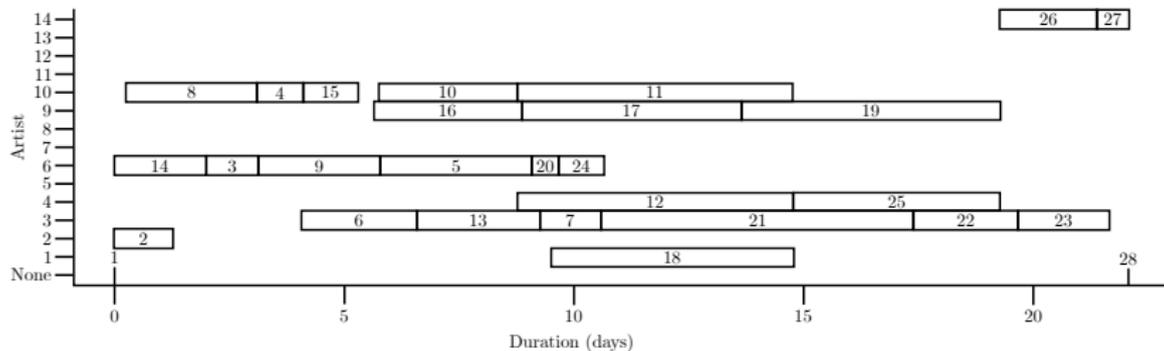
# Texturing



# Lighting and Compositing



# Example Schedule



Minimise the duration of the project

minimise  $W$

Minimise the duration of the project

minimise  $W$

Minimise the total cost of the project

minimise  $\sum_{j \in \mathcal{A}} R_j(\theta_j - \eta_j)$

Ensures that each task may only be assigned to a single artist

$$\sum_{j \in \mathcal{A}} x_{ij} = 1, \quad i \in \mathcal{T}$$

# Constraints

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Ensures that each task may only be assigned to an artist who meets the minimum skill requirements of the task

$$r_{ik}x_{ij} \leq s_{jk}M, \quad i \in \mathcal{T}, \quad j \in \mathcal{A}, \quad k \in \mathcal{S}$$

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$$r_{ik}x_{ij} \leq s_{jk}M, \quad i \in \mathcal{T}, \quad j \in \mathcal{A}, \quad k \in \mathcal{S}$$

Defines the duration of a task

$$d_{ij} = b_i \times \sum_{k \in \mathcal{S}} \left( \frac{r_{ik}}{s_{jk}} \times \frac{r_{ik}}{\sum_{q \in \mathcal{S}} r_{iq}} \right) \quad i \in \mathcal{T}, \quad j \in \mathcal{A}$$

# Constraints

Ensures a task is not begun before its predecessor has been completed

$$y_\ell \geq y_i + d_{ij}x_{ij}, \quad i \in \mathcal{P}_\ell, \quad j \in \mathcal{A}, \quad \ell \in \mathcal{T}$$

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Ensures that an artist is not required to work on more than one task simultaneously

$$y_i + (d_{ij} + M)\zeta_{ilj} \leq y_\ell + M + Nz_{ilj}, \quad i, \ell \in \mathcal{T}, \quad j \in \mathcal{A}$$
$$y_\ell + (d_{\ell j} + M)\zeta_{ilj} \leq y_i + M + N(1 - z_{ilj}), \quad i, \ell \in \mathcal{T}, \quad j \in \mathcal{A}$$

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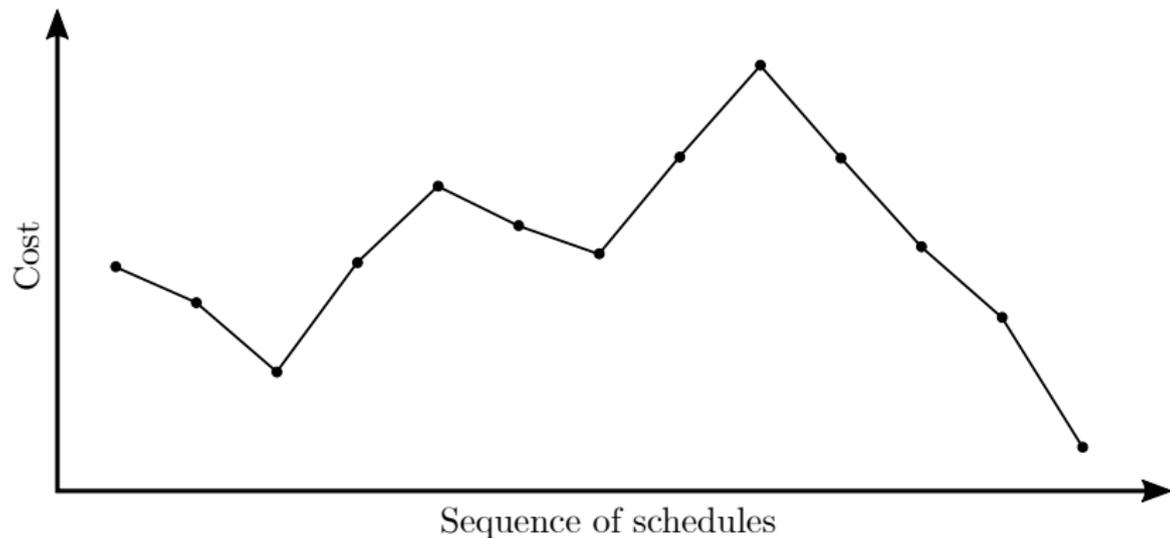
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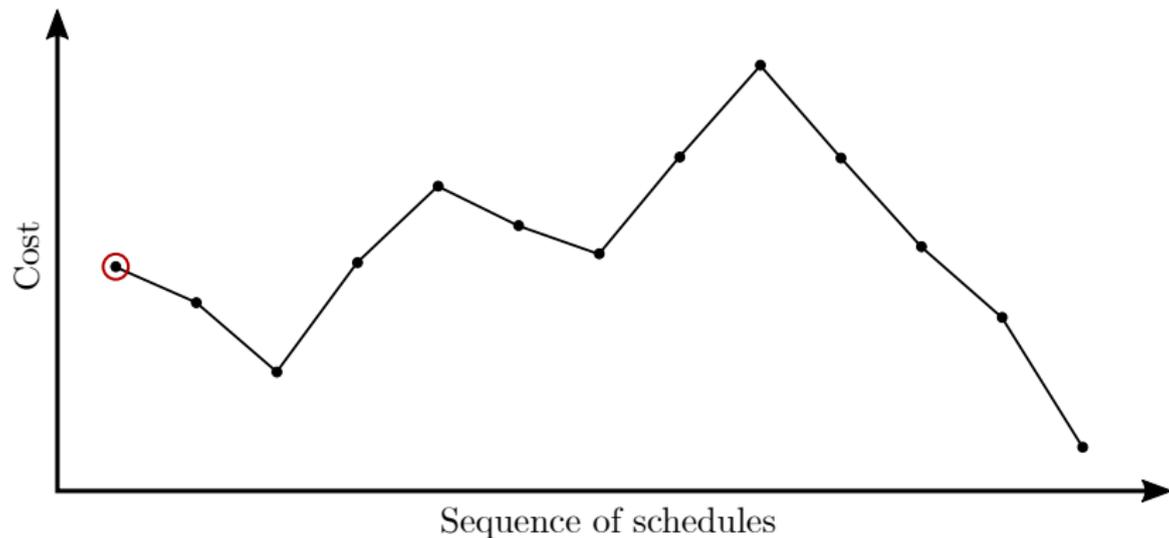
Defines start and end times for artists

$$\eta_j - M \leq y_i - Mx_{ij}, \quad i \in \mathcal{T}, \quad j \in \mathcal{A}$$
$$y_i + (d_{ij} + M)x_{ij} \leq M + \theta_j, \quad i \in \mathcal{T}, \quad j \in \mathcal{A}$$
$$\eta_j \leq \theta_j, \quad j \in \mathcal{A}$$

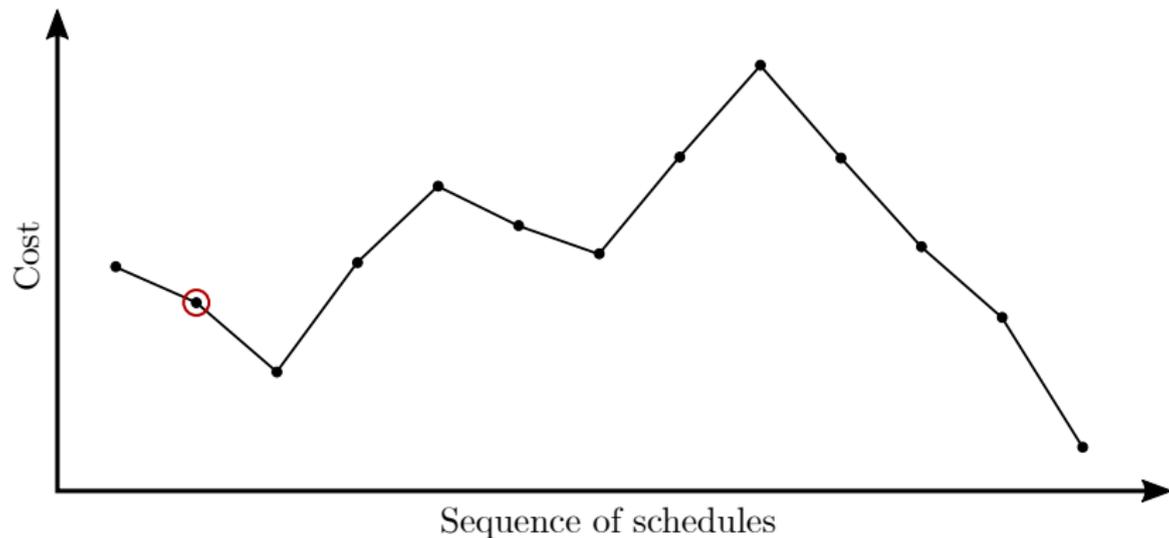
# Finding the optimal schedule



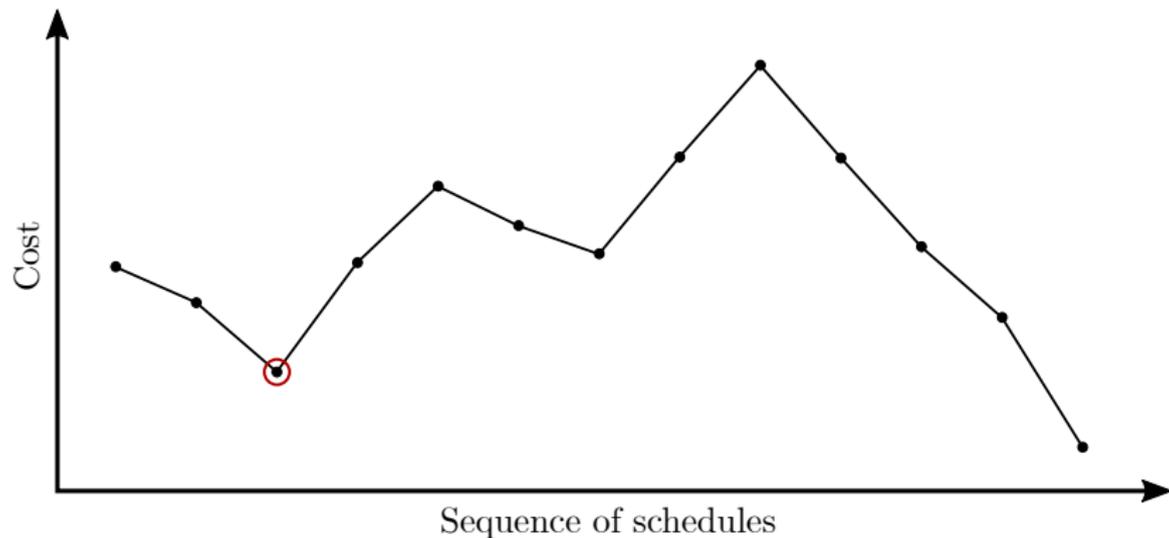
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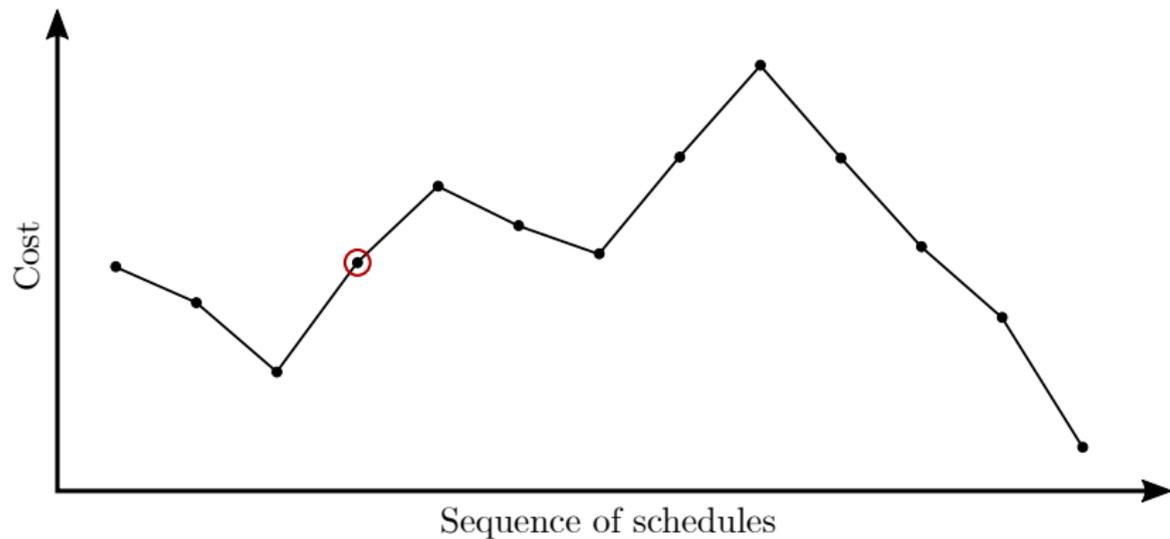
# Finding the optimal schedule



# Finding the optimal schedule



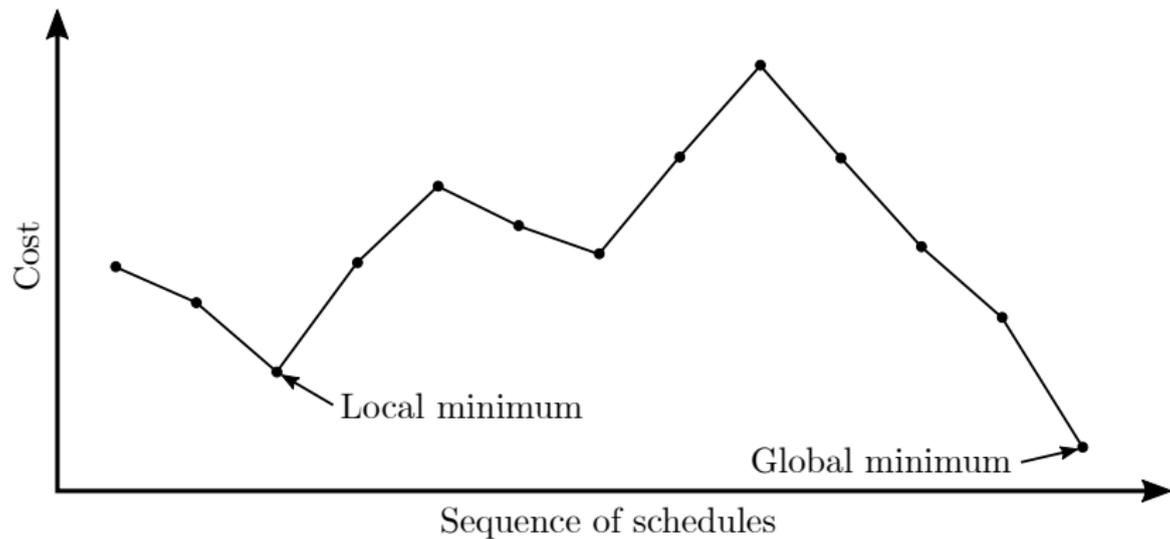
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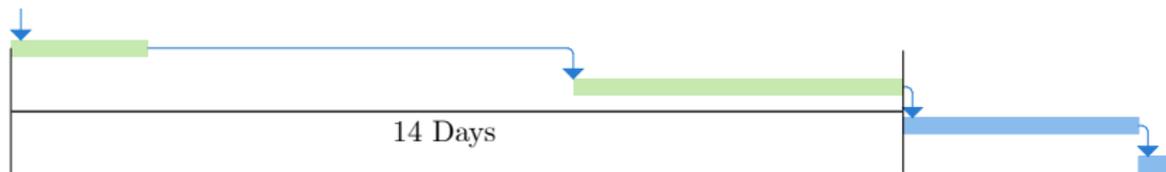


- The agent-to-task assignment swap operator

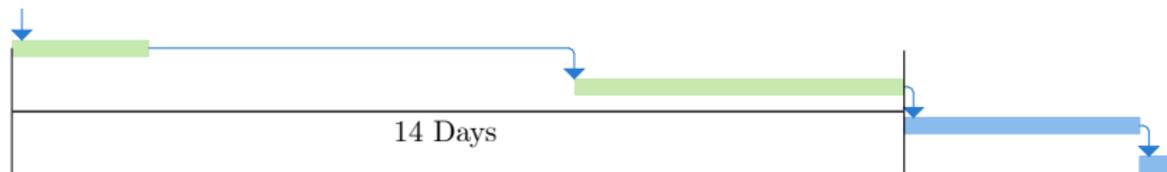
# Change Operators

- The agent-to-task assignment swap operator
- The time-shift operator

# Change Operators



# Change Operators



# Change Operators

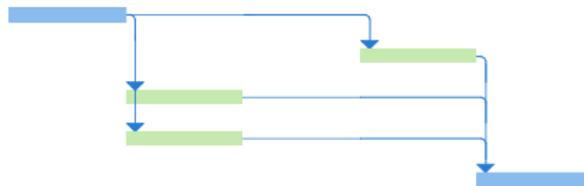
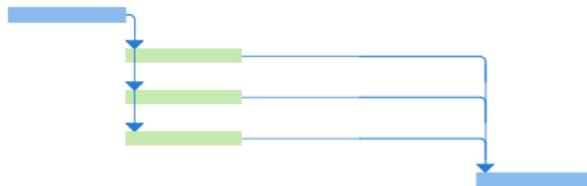
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- The time-shift operator
- The artificial precedence relation insertion operator

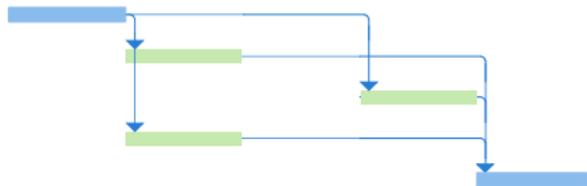
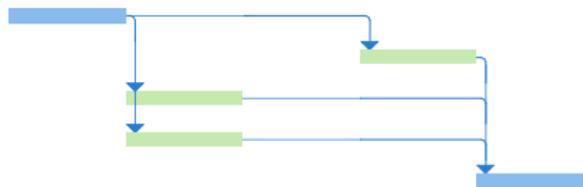
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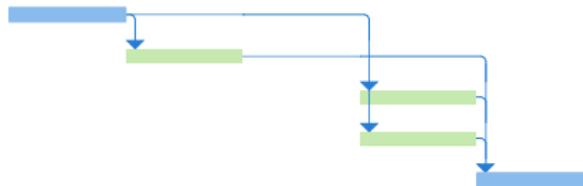
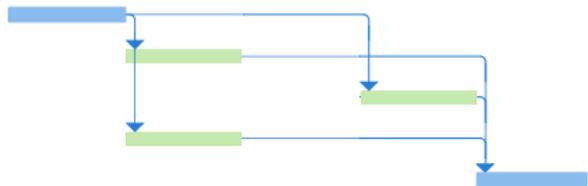
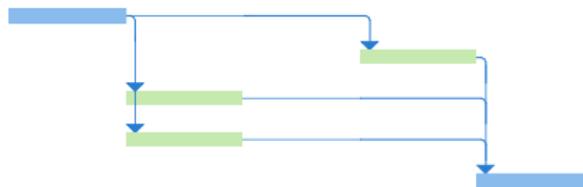
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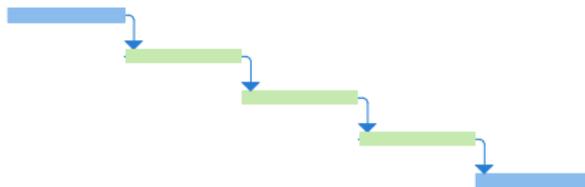
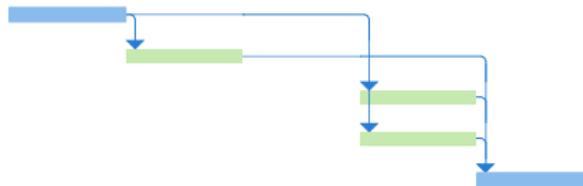
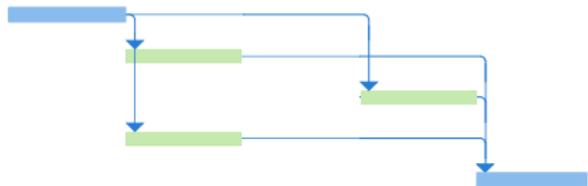
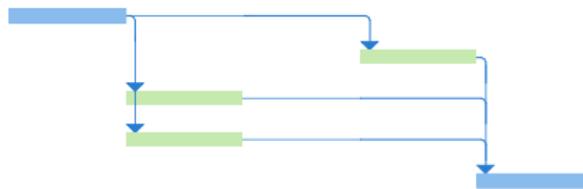
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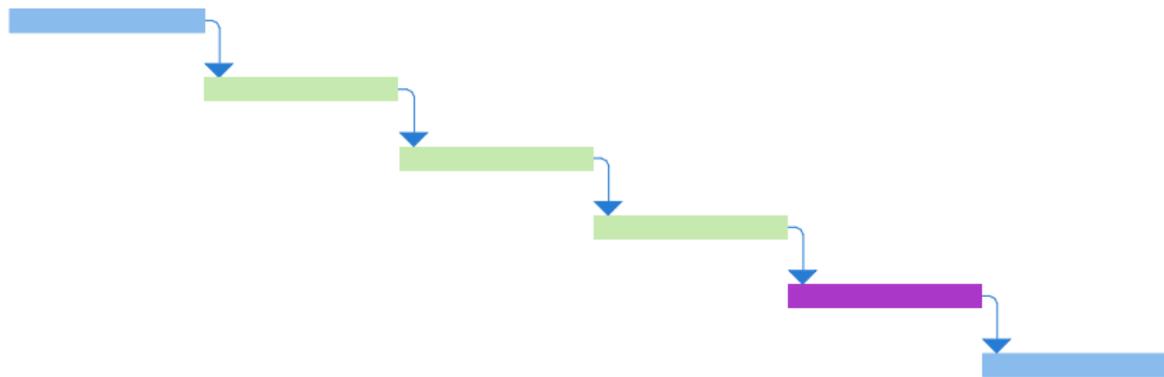
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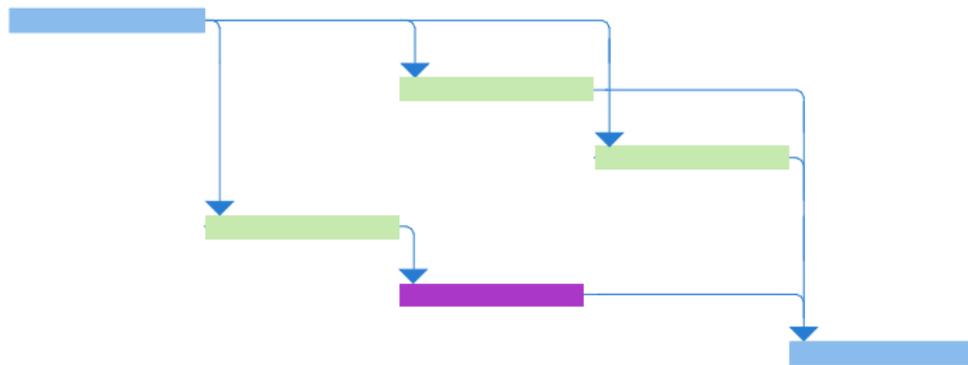
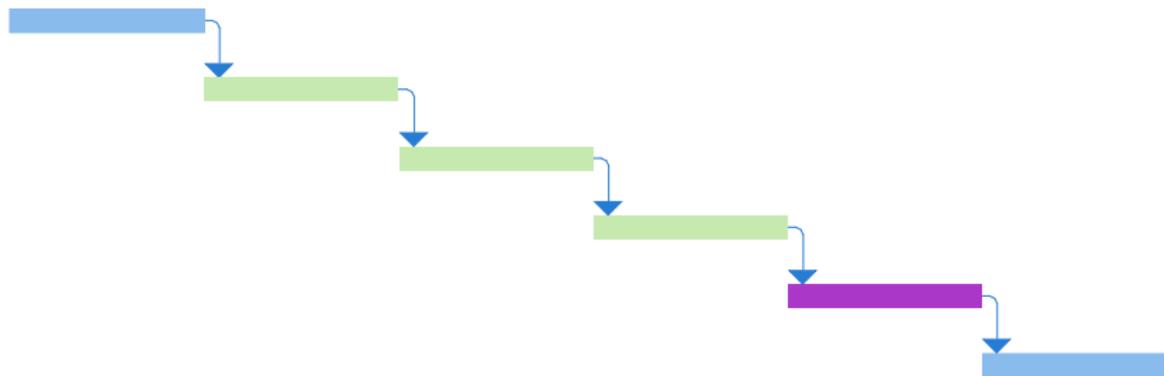
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- The agent-to-task assignment swap operator
- The time-shift operator
- The artificial precedence relation insertion operator
- The artificial precedence relation reordering operator

# Change Operators



# Change Operators



## Uploading Files

### Input Task Details

Task Details.csv

Upload complete

### Input Artist Details

Artist Details.csv

Upload complete

### Input Task Complexity Ratings

Task Complexity Ratings.csv

Upload complete

### Input Artist Skill Ratings

Artist Skill Ratings.csv

Upload complete

The process was completed after 34.86 minutes. Please see the results tab.



# Case Study Data Set

Data set received from Triggerfish Animation Studios entails:

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- ① 244 tasks
  - ① 14 rigging tasks
  - ② 15 layout tasks
  - ③ 215 animation tasks

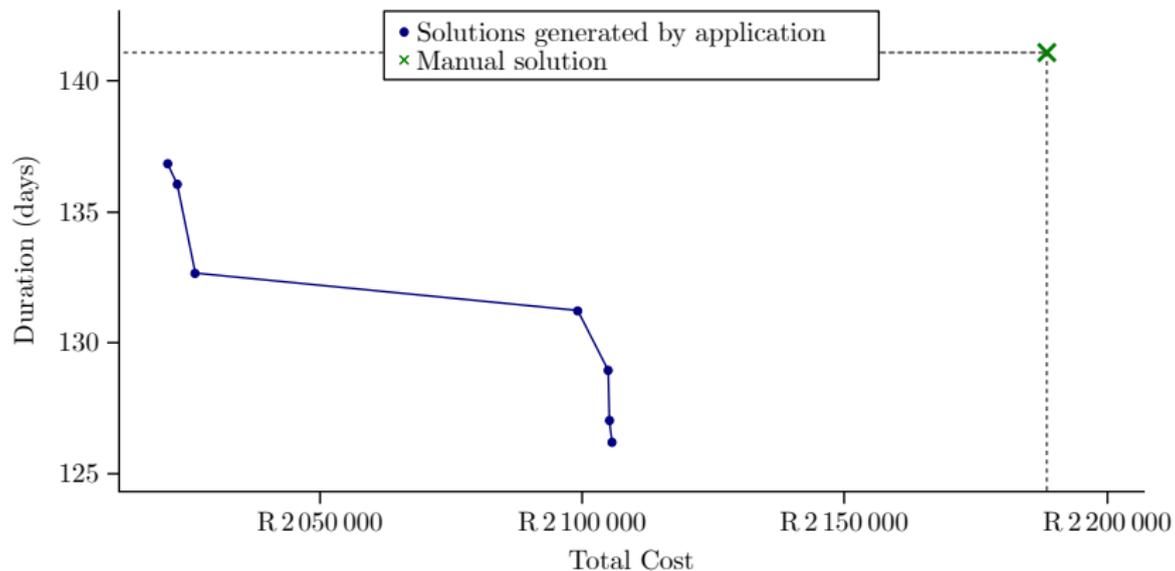
Data set received from Triggerfish Animation Studios entails:

- 1 244 tasks
  - 1 14 rigging tasks
  - 2 15 layout tasks
  - 3 215 animation tasks
- 2 4 skills
  - 1 Rigging
  - 2 Layout
  - 3 Acting animation
  - 4 Body mechanics animation

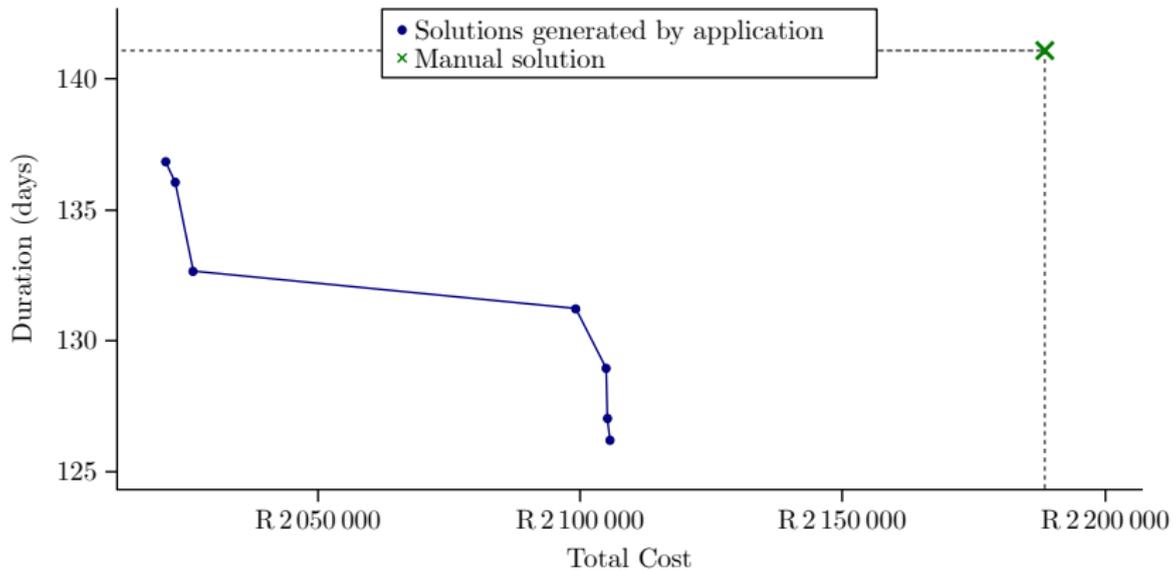
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  - 1 14 rigging tasks
  - 2 15 layout tasks
  - 3 215 animation tasks
- 2 4 skills
  - 1 Rigging
  - 2 Layout
  - 3 Acting animation
  - 4 Body mechanics animation
- 3 22 artists
  - 1 4 rigging artists
  - 2 4 layout artists
  - 3 14 animation artists

# Case Study Results

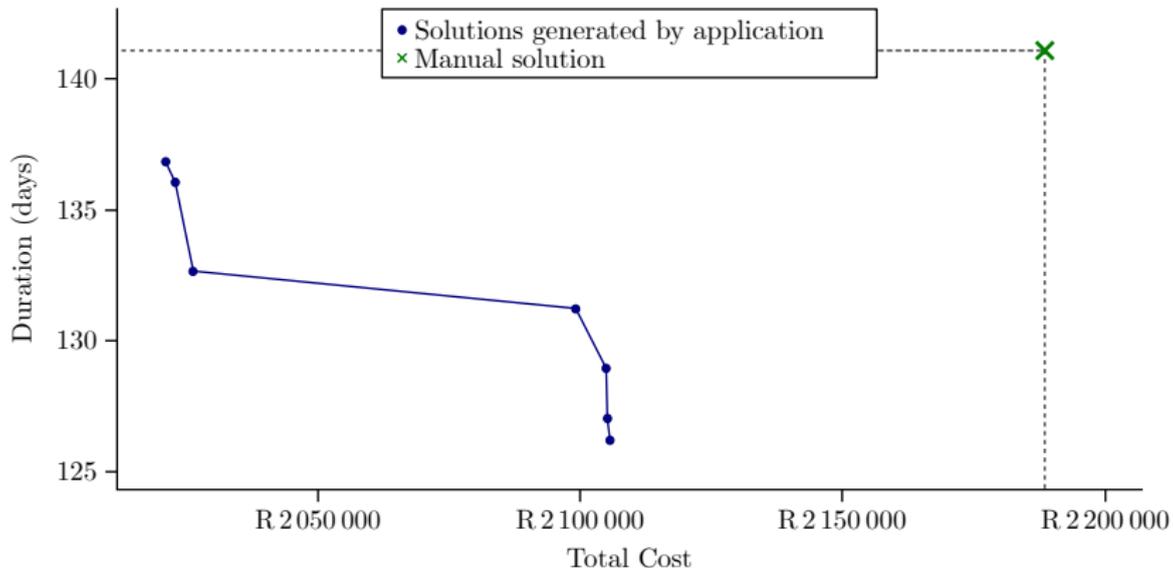


# Case Study Results



① Reduces project duration by 15 days

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- 1 Reduces project duration by 15 days
- 2 Reduces project cost by R160 000

## Project contribution towards society

- 1 The application is scheduled to be presented to Triggerfish Animation Studios

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- 2 It will hopefully be incorporated into their scheduling procedure
- 3 This would result in the generation of higher quality schedules in a shorter duration of time, significantly reducing the costs involved
- 4 The application has the potential to replace the manual scheduling process entirely

Thank you for your attention.