Wood Plank Production

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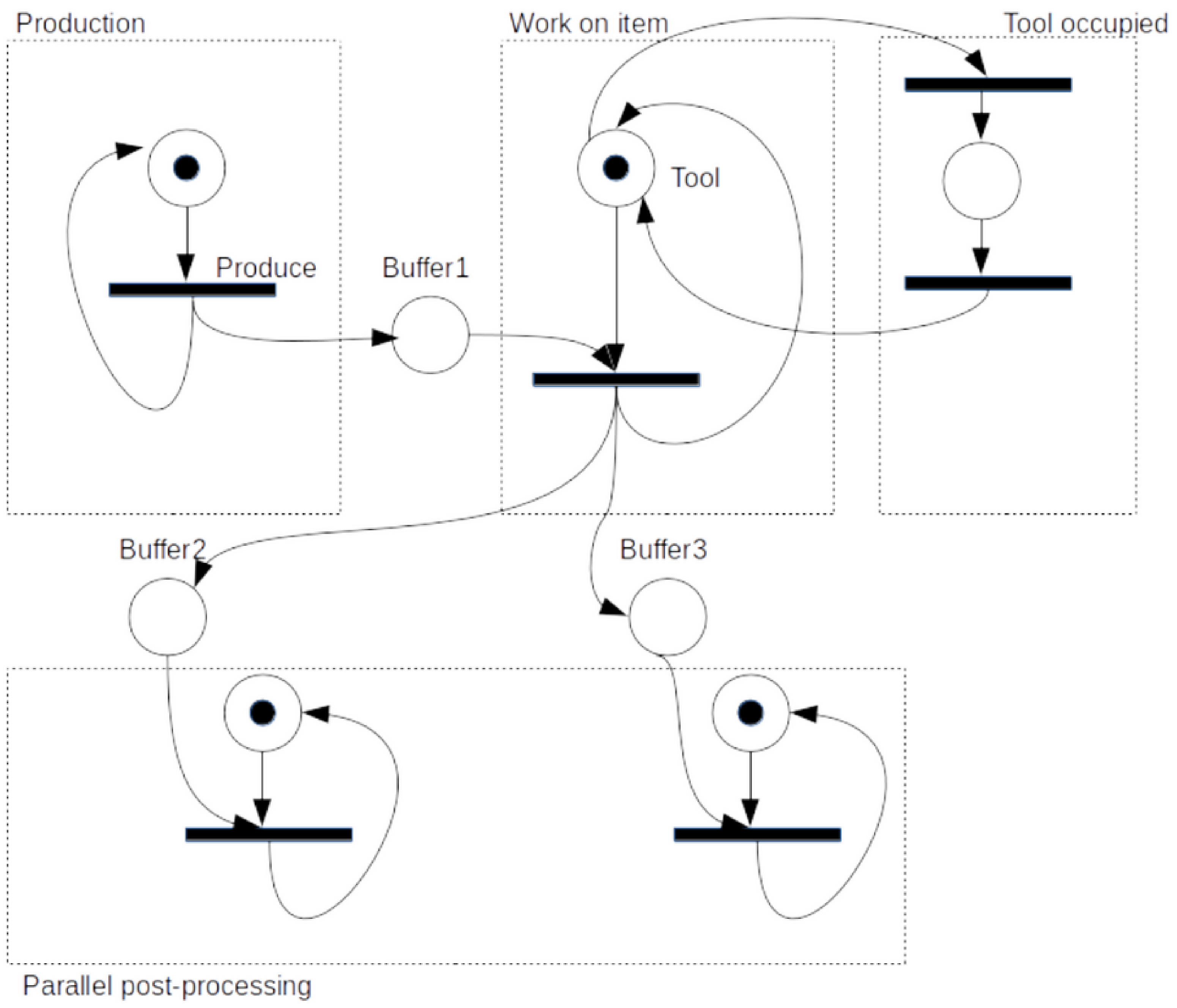
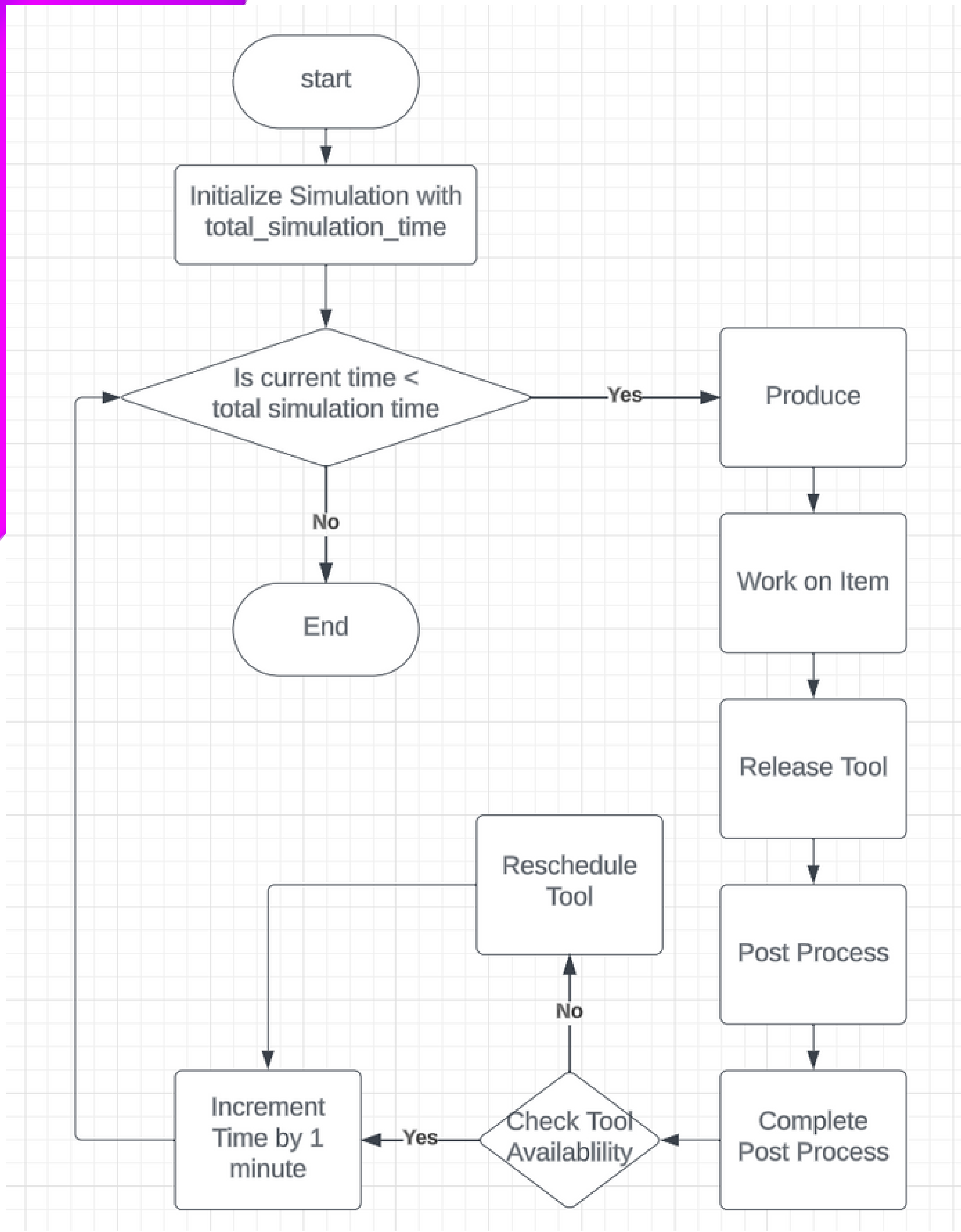
Overview of the Simulation Model



This Petri net provides a visual workflow of wood plank production, from raw materials to the final post-processing stages.

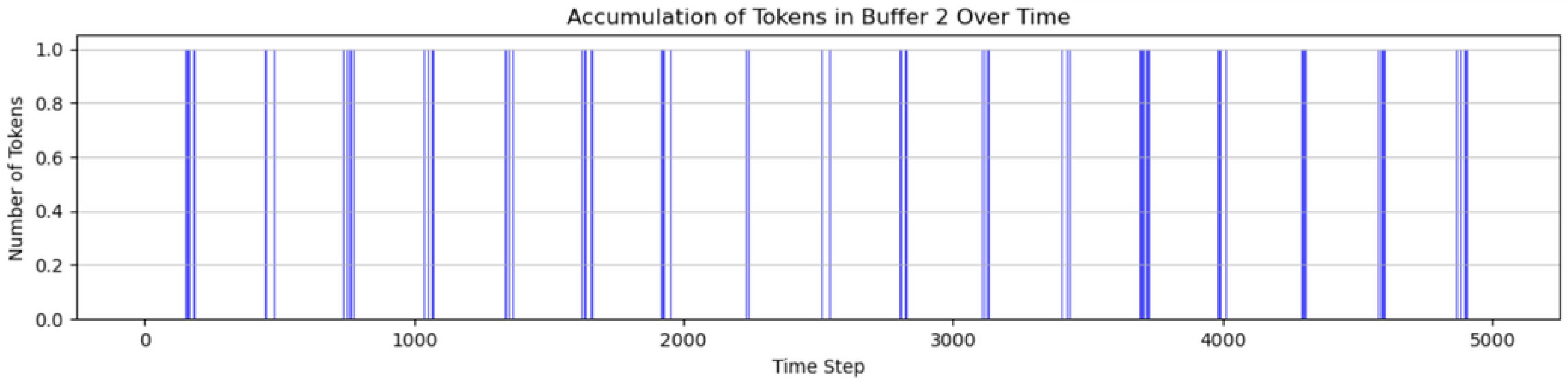
- Production Area: Represents the start of the wood plank production process.
- Buffer 1: A holding area where planks wait to be worked on.
- Work on Item: The station where planks are processed.
  - Tool: Symbolizes machinery or tools used to work on planks.
- Tool Occupied: Indicates when the tool is in use.
- Buffer 2 and Buffer 3: Storage areas post-processing.
- Parallel Post-Processing: Final stages where planks are treated or packaged.

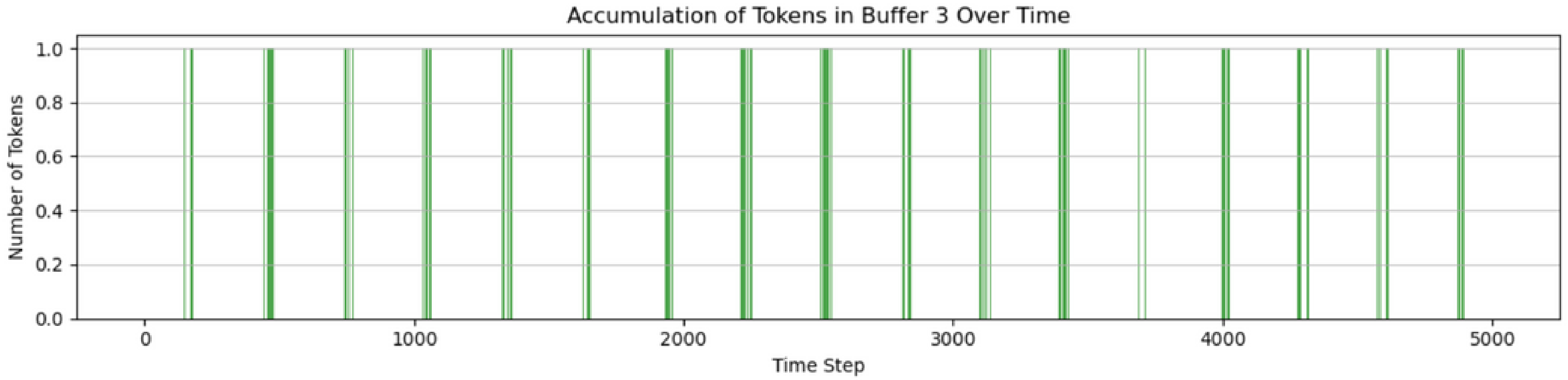
Flowchart



- Start: Begin the simulation process.
- Initialize Simulation: Set the total simulation time for the process.
- Time Check: Continuously check if the current time is less than the total simulation time.
- Produce: Engage in the production phase if time conditions are met.
- Work on Item: Process the item after production.
- Release Tool: Free up the tool post-processing on the item.
- Check Tool Availability: Before working on the item, verify tool availability.
- Reschedule Tool: If the tool is not available, reschedule the work on the item.
- Post-Process: Conduct post-processing steps once the item work is complete.
- Complete Post-Process: Finish the post-processing phase.
- Increment Time: After each cycle, increment the simulation clock by one minute.
- End: Conclude the simulation when the total simulation time is reached.

Buffer Capacity Analysis



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Buffer 2 Capacity Estimates at 50 Percentiles: 0.0
Buffer 2 Capacity Estimates at 75 Percentiles: 0.0
Buffer 2 Capacity Estimates at 90 Percentiles: 1.0
Buffer 2 Capacity Estimates at 95 Percentiles: 1.0
Buffer 2 Capacity Estimates at 99 Percentiles: 1.0
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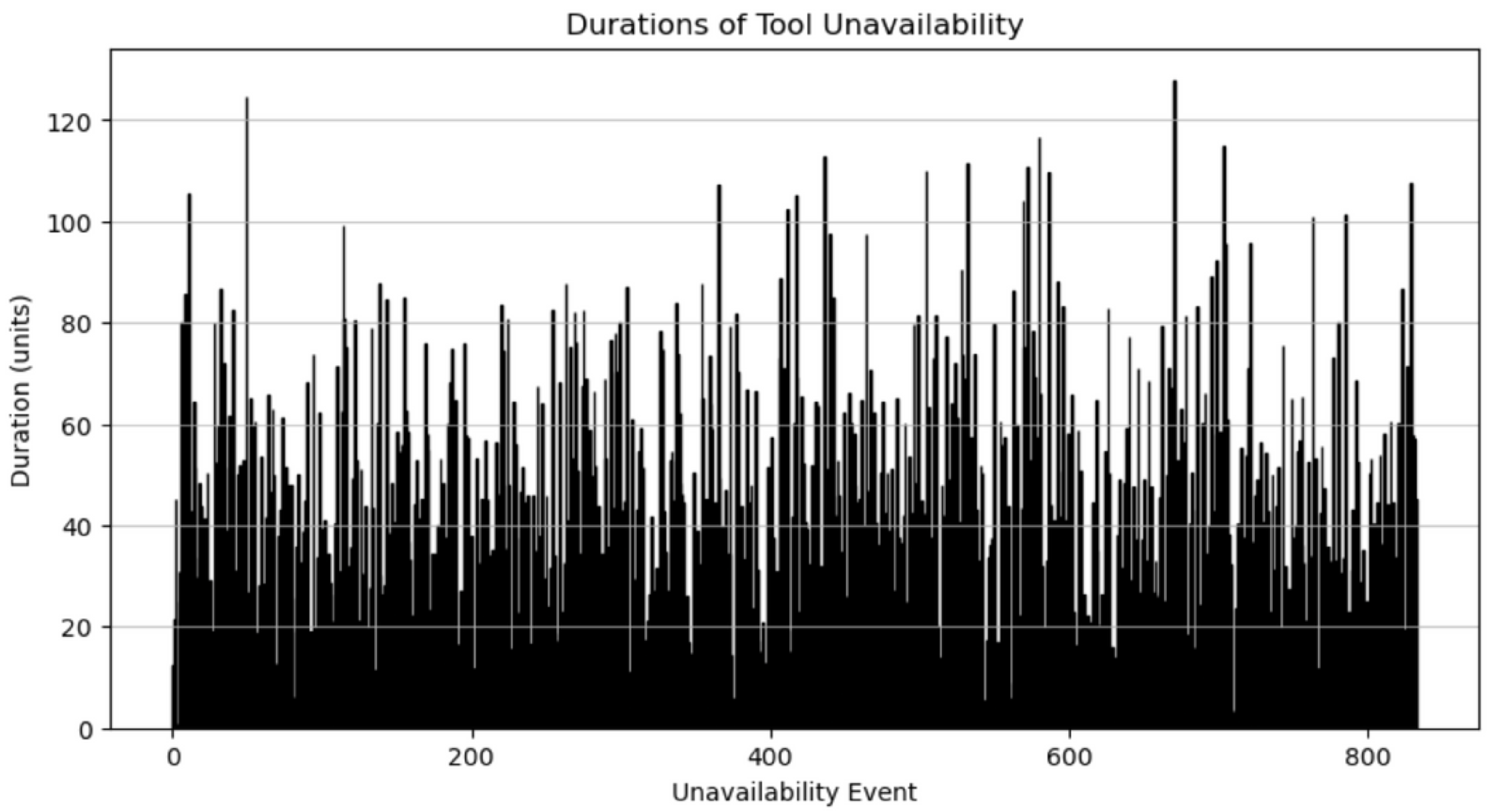
Buffer 3 Capacity Estimates at 50 Percentiles: 0.0
Buffer 3 Capacity Estimates at 75 Percentiles: 0.0
Buffer 3 Capacity Estimates at 90 Percentiles: 0.0
Buffer 3 Capacity Estimates at 95 Percentiles: 1.0
Buffer 3 Capacity Estimates at 99 Percentiles: 1.0
```

- The graphs represent the token dynamics within Buffer 2 and Buffer 3 over time, with tokens symbolizing the presence of work items or tasks.
- Tokens have an equal probability (50%) of being routed to either Buffer 2 or Buffer 3 after the 'Tool Occupied' stage.
- The time steps (x-axis) quantify the simulation's progression, while the y-axis denotes token count within each buffer.
- Sharp vertical spikes illustrate moments when tokens enter a buffer. The swift return to zero after these spikes indicates that tokens are quickly processed and moved out, showing efficient buffer management.
- The regular pattern of spikes suggests a consistent workflow, with each buffer receiving and clearing tokens systematically, which is indicative of a well-tuned process.
- The absence of a build-up of tokens in both graphs implies that there are no enduring delays or backlogs in either Buffer 2 or Buffer 3, and the buffers are capable of handling incoming workload without causing a bottleneck in the system.
- The similarity in patterns between Buffer 2 and Buffer 3 indicates that the post-processing stages for both buffers are well-coordinated, ensuring that neither buffer becomes a system bottleneck.

Handling Tool Unavailability

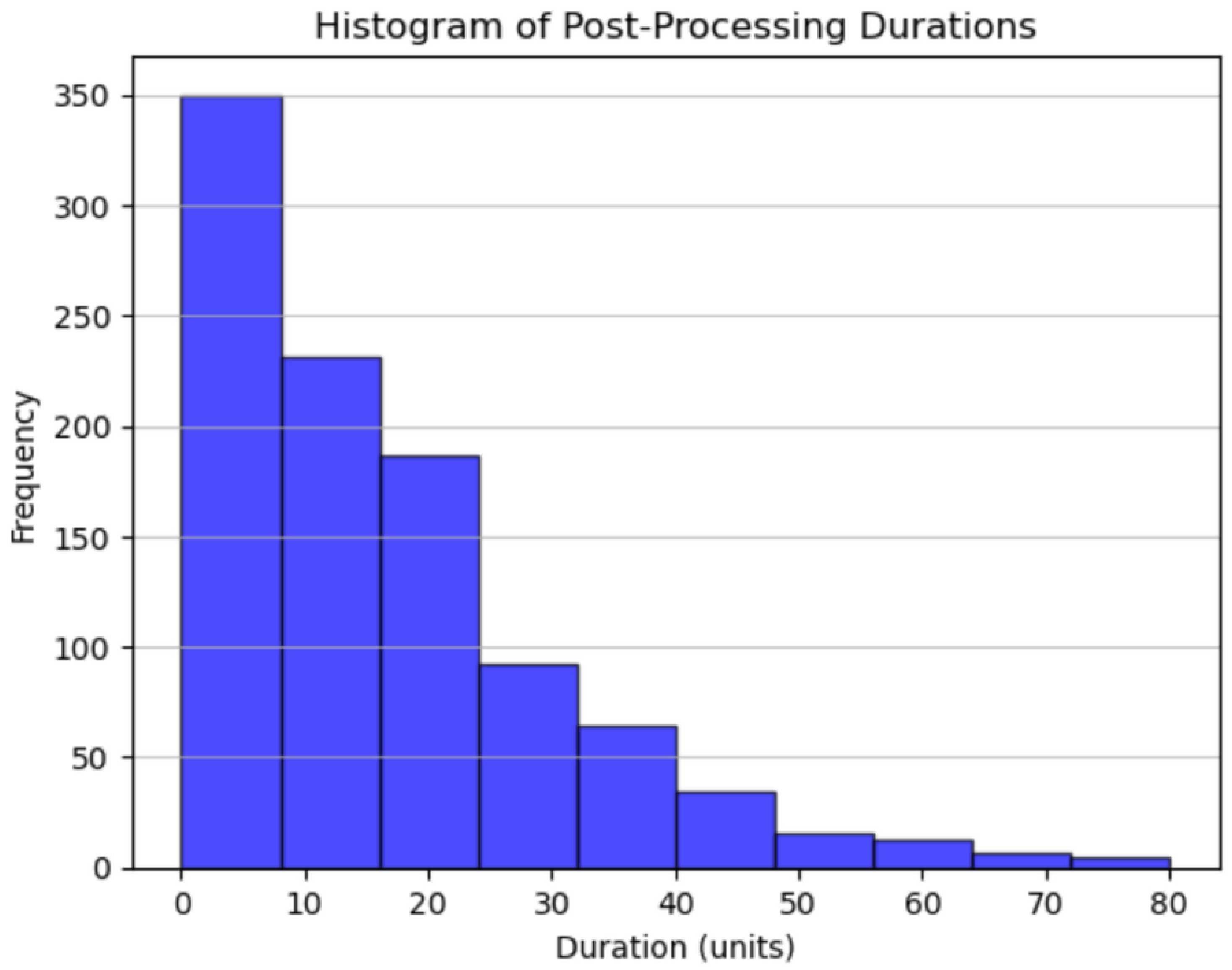


- The simulation models tool unavailability as a stochastic event with a 10% occurrence probability.
- Over 2000 simulated time steps, there were 833 instances where the tool was unavailable.
- The total combined duration of tool unavailability amounted to approximately 32,799.33 time units.
- The bar chart visualizes the randomness and variability in the duration of each unavailability event.
- This analysis helps in understanding the impact of tool unavailability on the overall process efficiency and can aid in developing contingency plans or improvements in the workflow to mitigate downtime.

Work Occurrence when Tool Available

- The simulation ran for 12 hours across 1000 iterations, during which there were 883 instances of work performed while the tool was available. This indicates that out of the possible number of work instances that could have occurred during the total simulation time, 883 instances were completed without any interruption due to tool unavailability. Given that the tool had a 10% chance of being unavailable at any given time, the figure of 883 successful work instances can be used to assess the operational efficiency and the impact of tool downtime on production.
- For instance, if theoretically the production process could initiate a work instance every minute, over a 12-hour period (720 minutes) without any downtime, there would be 720 potential work instances. Since the simulation allows for 1000 iterations, this could imply multiple work instances within the same minute or varying durations for each work instance. The result of 883 successful work instances suggests that the stochastic nature of tool unavailability (set at 10%) has a noticeable but not debilitating effect on the production process. The performance of the production system could be further analyzed by comparing the 883 instances against the total number of possible instances without downtime, adjusted for the number of iterations, to quantify the impact on productivity and efficiency.

Post-process Analysis

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Average Post-Processing Duration: 16.142519089151776
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- The majority of post-processing events are quick, with a peak frequency between 0 and 10 units.
- There is a noticeable decline in frequency as the duration increases, indicating fewer events take longer.
- The average post-processing duration is around 16.14 units.
- Very few post-processing events take longer than 40 units of time.
- The spread of durations from 10 to 30 units suggests variability in the post-processing time, which could be due to different task complexities or system performance fluctuations.