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FlexSim Tutorial practice submission

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BITS ID : 202018BT680
SUBJECT : FLEXSIM – VIRTUAL LAB PRACTICE
(TUTORIAL 1 TO TUTORIAL 8)

Hall Ticket



Birla Institute of Technology & Science, Pilani(Raj.)

Work Integrated Learning Programmes Division

2022-2023 SEM 1

HALL TICKET FOR EC2 EC2 REGULAR

ID No : 202018bt680
Name : SUDHARSAN S
Degree : BTech - Engineering Technology
Download Date & Time : 13/09/2022 - 9:02:15 AM



Course Code	Course Name	Exam Type	Exam Date and Slot	Exam Venue
ETZC424	PLANT LAYOUT & DESIGN	EC2 REGULAR	2022-09-24,SATURDAY, NS_FORENOON_RG1	ONLINE-EXAMS -
ETZC344	INSTRU & CONTROL	EC2 REGULAR	2022-09-24,SATURDAY, NS_AFTERNOON_RG1	ONLINE-EXAMS -
ETZC343	MATERIALS MANAGEMENT	EC2 REGULAR	2022-09-25,SUNDAY, NS_FORENOON_RG2	ONLINE-EXAMS -
ETZC423	ESSENTIALS OF PROJECT MGMT	EC2 REGULAR	2022-09-25,SUNDAY, NS_AFTERNOON_RG2	ONLINE-EXAMS -

Exam Timings FORENOON (FN) SESSION: 9:00 AM TO 11:15 AM IST AFTERNOON (AN) SESSION: 1:00 PM TO 3:15 PM IST
EVENING (EN) SESSION: 4:30 PM TO 6:45 PM IST

Booked slot screen slot



Dashboard

PAGES

Courses

Access Lab



Go To Job Portal

202018bt680@wilp.bits-pilani.ac.in



Booked Slots

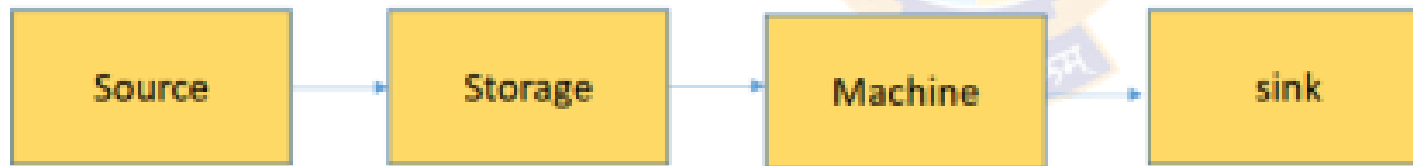
SL NO.	COURSE NAME	BOOKED DATE	BOOKED TIME	REMOVE	ACCESS LAB	REVIEW
1	Materials Management (Merged-ETZC343-PEZC343-SI-22)	2022-09-13	20:30-22:30	Cancel	Access Lab	★
2	Materials Management (Merged-ETZC343-PEZC343-SI-22)	2022-09-11	18:30-20:30	Cancel	Access Lab	★
3	Materials Management (Merged-ETZC343-PEZC343-SI-22)	2022-09-04	20:30-22:30	Cancel	Access Lab	★
4	Materials Management (Merged-ETZC343-PEZC343-SI-22)	2022-09-03	20:30-22:30	Cancel	Access Lab	★
5	Materials Management (Merged-ETZC343-PEZC343-SI-22)	2022-08-16	20:30-22:30	Cancel	Access Lab	★

Model view: Tutorial 1 Output comparison: Basic model

In a common production system shop floor, parts are arriving based on an exponential distribution (0, 10, 0) minutes. Single machine is processing the parts in 10 minutes each. Estimate throughput of 8Hr (8x60 = 480min) shift of the system if,

1. One operator is involved in transferring the product from storage to machine
2. Same operator is taking the product from storage to sink
3. Different operators are involved to carry products on the either side of the machine.

Material flow:



Model view: Tutorial 1 Output comparison: Basic model

Model Page: One operator is involved in transferring the product from storage to machine

The screenshot displays the FlexSim 2020 software interface. The main workspace shows a 3D model of a production line on a grid. The components are arranged as follows: a 'Source' block on the left, a 'Storage' block in the center-left, a 'Machine' block in the center-right, and a 'Sink' block on the right. A 'Transporter' block connects the Source to the Storage, and another connects the Machine to the Sink. An 'Operator2' block is positioned between the Storage and Machine blocks, with a line connecting it to the Storage block. The interface includes a top menu bar with options like File, Edit, View, Execute, Statistics, and Debug. Below the menu is a toolbar with icons for various functions. On the left side, there is a 'Library' panel with categories such as Fixed Resources, Task Executors, Travel Networks, Conveyors, and Warehousing. On the right side, there is a 'Properties' panel with sections for Views, View Settings, View Style, Capture View, and Follow Object. The status bar at the bottom shows the mouse position as [-13.95, -13.40, 0.00].

Model view: Tutorial 1 Output comparison: Basic model

1.1 One operator is involved in transferring the product from storage to machine

The screenshot displays the FlexSim 2020 software interface. The main workspace shows a simulation model with the following components: a Source, a Storage rack, an Operator (a yellow figure), a Machine (a green robot), and a Sink. The Operator is positioned between the Storage and the Machine. The simulation is running, with a Run Time of 480.00 to 480.00 and a Run Speed of 448.

An Output window is open, showing a table with the following data:

Object	Throughput
Sink	47

The Properties panel on the right shows the following settings:

- Views:** (Empty)
- View Settings:**
 - Working Mode: (Dropdown)
 - Perspective Projection
 - Show Connections
 - Show Grid
 - Snap to Grid
 - Snap to Background
 - 1st Person
 - Ignore Objects
 - VR Mode
 - RTX Mode (Beta)
 - Sync Views
 - Grid Z: 0.00
- View Style:**
- Capture View:**
 - Width: 1920
 - Height: 1080
 - Capture View (Button)
- Follow Object:**
 - Rotate with Object

The bottom status bar shows the mouse position as [-5.40, -13.48, 0.00] and the system clock as 9:06 PM 9/3/2022.

Model view: Tutorial 1 Output comparison: Basic model

1.2 Same operator is taking the product from storage to sink

The screenshot displays the FlexSim 2020 interface. The main workspace shows a simulation model with the following components and flow:

- Source:** A blue cube representing the starting point of the material flow.
- Storage:** A brown rectangular block where the material is held.
- Machine:** A green and white industrial machine that processes the material.
- Sink:** A yellow and blue cube representing the final destination of the material.

Arrows indicate the flow from Source to Storage, then to Machine, and finally to Sink. A central cross symbol is positioned between the Storage and Machine components.

An **Output** window is open, displaying a table of data:

Object	Throughput
Sink	47

The **Properties** panel on the right shows the configuration for the selected **Operator2**:

- Content:** A table with columns Curr, Min, Max, Avg. Values: Curr (0.00), Min (0.00), Max (1.00), Avg (0.01).
- Staytime:** A table with columns Min, Max, Avg. Values: Min (0.06), Max (0.07), Avg (0.06).
- Total Travel:** 539.85
- Visuals:** fs3d\Operator\OperatorMale_LowRes\Oper...
- Labels:** Automatically Reset (unchecked)
- Person Visuals:** Shape (Male Operator), Skin Texture (Male Operator)
- Operator:** Do Animations (checked), Idle (Stand), Walk (Walk), Walk Loaded (WalkLoaded)
- TaskExecutor:** Capacity (1), Load Time (0), Unload Time (0)

The status bar at the bottom indicates the current object is **Operator2** at position [12.60, -0.32, 0.00] with a scale of [0.40, 0.58, 1.78]. The system clock shows 9:31 PM on 9/3/2022.

Model view: Tutorial 1 Output comparison: Basic model

1.3 Different operators are involved to carry products on the either side of the machine.

The screenshot displays the FlexSim 2020 software interface. The main workspace shows a simulation model with the following components and data:

- Source:** A blue square icon representing the product source.
- Storage:** A yellow square icon representing a storage area. Its current state is: CurContent: 13, MaxContent: 16, AvgStaytime: 79.8.
- Operator2:** A yellow figure icon positioned between the Storage and Machine.
- Machine:** A green machine icon representing the processing unit.
- Sink:** A blue square icon representing the final destination.

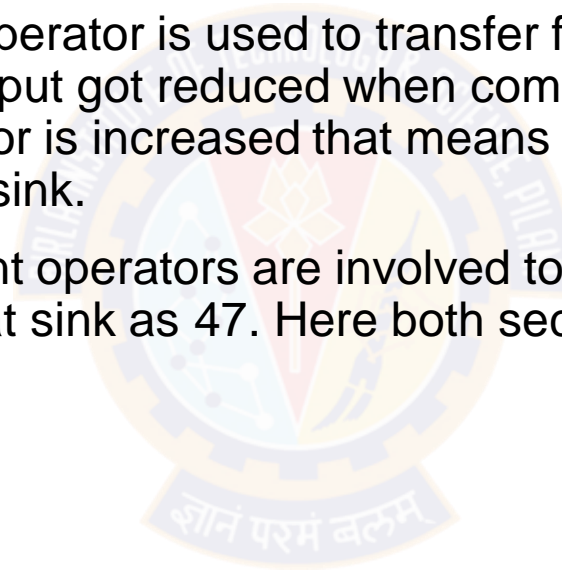
The **Dashboard** window on the right displays the following output:

Object	Throughput
Sink	47

The **Properties** window on the right shows the **Dashboard Properties** for the dashboard, including the dashboard name, image path, and edit mode status.

Comparison remarks

- While performing 1.1 one operator involved in transferring products from storage to machine for 8hrs results an output in the sink was 47 .
- While performing 1.2 If the same operator is used to transfer from storage to sink for 8hrs means the output remain 47 . Here the output got reduced when compared with above results(1.1) because the workload of an operator is increased that means same operator has to transfer product from storage to machine & sink.
- While performing 1.3 when Different operators are involved to carry products on the either side of the machine resulted an output at sink as 47. Here both second and third case gave same output.



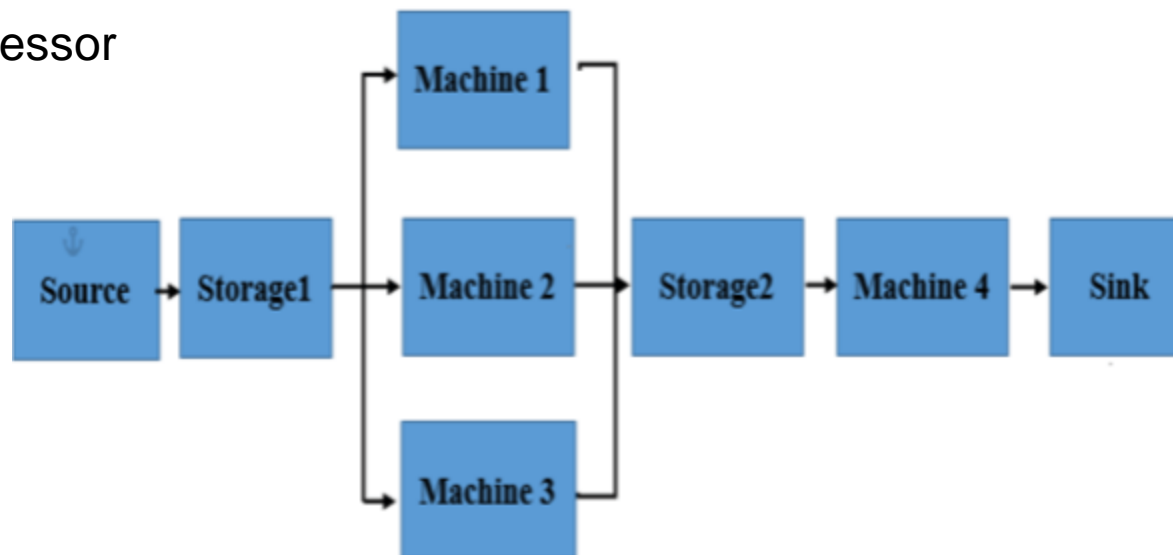
Model view: Tutorial 2 Throughput Estimation

A shop floor inside a tractor manufacturing company manufactures mainly three different products. The parts enter the shop floor every 5 min. The parts can be processed in any of the three parallel machines with processing time 10 min, while the processing time for machine 4 is 4 min.

The products are routed to the downstream machines in a round robin fashion. With Machine 1, 2 & Machine 3 require operator to transport items from storage. Build the model and run the simulation model for a period of 4320 minutes. The following are the objectives to be evaluated via simulation.

1. Report the average waiting time at the raw material inventory
2. Analyze the impact of material transport using operators on the production throughput by:
 - 2.1 Adding operator for all three processor
 - 2.2 No transport for all the processor

Material flow:



Model view: Tutorial 2 Throughput Estimation

Model Page

The screenshot displays the FlexSim 2020 software interface for a simulation model. The main workspace shows a flow starting from Source1, passing through Queue1, which then branches into three parallel paths: Processor1, Processor2, and Processor3. These paths converge into Queue2, followed by Processor4, and finally Sink1. The interface includes a Library on the left with categories like Fixed Resources, Task Executors, Travel Networks, Conveyors, and Warehousing. The top toolbar contains various simulation controls like Run, Stop, and Step. The Properties panel on the right shows View Settings and View Style options. The status bar at the bottom indicates the mouse position and system time.

Library

- Fixed Resources
 - Source
 - Queue
 - Processor
 - Sink
 - Combiner
 - Separator
 - MultProcessor
 - BasicFR
- Task Executors
 - Dispatcher
 - TaskExecutor
 - Operator
 - Transporter
 - Elevator
 - Robot
 - Crane
 - ASRSVehicle
 - BasicTE
- Travel Networks
 - NetworkNode
 - TrafficControl
- Conveyors
 - Straight Conveyor
 - Curved Conveyor
 - Join Conveyors
 - Decision Point
 - Station
 - Photo Eye
 - Motor
 - Merge Controller
- Warehousing
 - Rack
 - Floor Storage
 - Paint Slot Labels

Model

Source1 Queue1 Processor1 Processor2 Processor3 Queue2 Processor4 Sink1

Properties

- Views
- View Settings
 - Working Mode
 - Perspective Projection 1st Person
 - Show Connections Ignore Objects
 - Show Grid VR Mode
 - Snap to Grid RTX Mode (Beta)
 - Snap to Background Sync Views
- View Style
- Capture View
 - Width: 1920
 - Height: 1080
 - Capture View
- Follow Object
 - Follow Object
 - Rotate with Object

Mouse Position [-20.93, -18.38, 0.00]

9:41 PM
9/3/2022

Model view: Tutorial 2 Throughput Estimation

2.1 Report the average waiting time at the raw material inventory

The screenshot displays the FlexSim 2020 software interface. The main workspace shows a simulation model with a Source, Queue1, Processor1, Operator2, Processor2, Queue2, Processor3, and Processor. The interface includes a menu bar, a toolbar, and a left-hand library with categories like Fixed Resources, Task Executors, Travel Networks, Conveyors, and Warehousing. The status bar at the bottom indicates the mouse position as [-19.74, 3.56, 0.00].

On the right side, two data tables are displayed:

Staytime

Object	Avg Staytime	Min Staytime	Max Staytime
Queue1	0.09	0.06	0.11
Queue2	0.00	0.00	0.00

Staytime By Type

Type	Avg Staytime	Min Staytime	Max Staytime
------	--------------	--------------	--------------

The bottom right corner of the screenshot shows the system tray with the date and time: 8:49 PM, 9/4/2022.

Model view: Tutorial 2 Throughput Estimation

2.2.1 Adding operator for all three processor

The screenshot displays the FlexSim 2020 software interface. The main workspace shows a simulation model with the following components:

- Source:** A blue cube icon on the left.
- Queue1:** A grey rectangular queue icon.
- Queue2:** A grey rectangular queue icon.
- Processor1:** A green machine icon at the top.
- Processor2:** A green machine icon in the middle.
- Processor3:** A green machine icon at the bottom.
- Operator2:** A yellow figure icon positioned between Queue1 and Queue2.

Connections are shown between Source and Queue1, Queue1 and Processor1, Queue1 and Processor2, Queue2 and Processor2, Queue2 and Processor3, and Queue2 and a final Processor on the right. A plus sign is located between Processor2 and Processor3.

On the right side of the interface, two data tables are displayed:

Staytime

Object	Avg Staytime	Min Staytime	Max Staytime
Queue1	0.09	0.06	0.11
Queue2	0.00	0.00	0.00

Staytime By Type

Type	Avg Staytime	Min Staytime	Max Staytime
------	--------------	--------------	--------------

The software interface includes a menu bar (File, Edit, View, Execute, Statistics, Debug, Help), a toolbar, and a library panel on the left with categories like Fixed Resources, Task Executors, Travel Networks, Conveyors, and Warehousing. The status bar at the bottom shows the mouse position as [-19.74, 3.56, 0.00] and the system time as 8:49 PM on 9/4/2022.

Model view: Tutorial 2 Throughput Estimation

2.2.2 No transport for all the processor

The screenshot displays the FlexSim 2020 interface. The main workspace shows a simulation model with the following components and connections:

- Source** (blue icon) feeds into **Queue1** (grey icon).
- Queue1** branches into three paths leading to **Processor1** (top), **Processor2** (middle), and **Processor3** (bottom).
- Each processor feeds into **Queue2** (grey icon).
- Queue2** feeds into **Processor4** (right).

On the right side, the **Properties** panel is open, showing the **Views** section with a table titled "Staytime":

Object	Avg Staytime	Min Staytime	Max Staytime
Queue1	0	0	0
Queue2	0	0	0

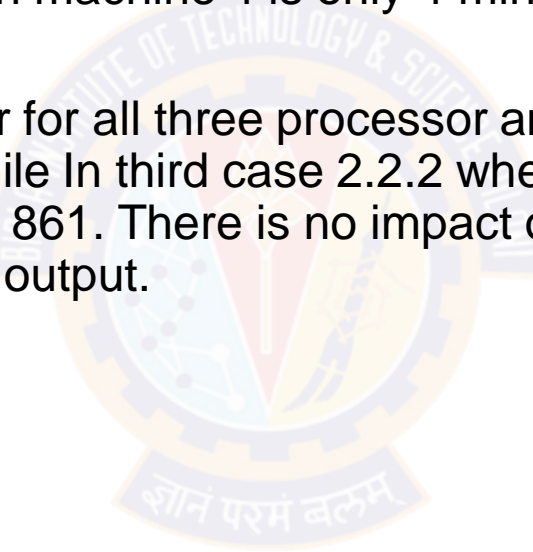
Below this table, another table titled "Staytime By Type" is visible, with columns for Type, Avg Staytime, Min Staytime, and Max Staytime.

The **View Settings** section includes options for Perspective Projection, Show Connections, Show Grid, Snap to Grid, and Snap to Background. The **View Style** section shows Width: 1920 and Height: 1080. The **Follow Object** section has the **Rotate with Object** checkbox checked.

At the bottom of the window, the system tray shows the date and time: 9:00 PM, 9/4/2022.

Comparison remarks

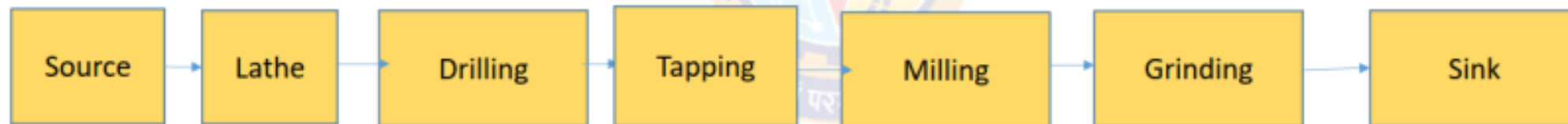
- In first case 2.1 When the model has run for 4320 minutes the average waiting time at storage 1 is very little that is 0.66 min and at storage 2 the waiting time is zero because process time of Machine 1,2 and 3 is 10 mins while in machine 4 is only 4 mins so it processed quickly and transferred it to sink
- In second case 2.2.1 Adding operator for all three processor and run the model for 4320 mins resulted an output at sink as 861 While In third case 2.2.2 when we removed all operators also gave same output at sink that is also 861. There is no impact on output either by adding or removing operators both gave same output.



Model view: Tutorial 3 Resource capacity validation

A machine shop receives parts following an exponential distribution $(0,3,0)$ minutes. It is arranged as indicated. It performs 5 different machining operations on a raw material piece part. The capacity and other factors are indicated below.

1. Find output from machine shop in 6Hr shift.
2. Find stay time at each inventory station.
3. Find ways to double the production by utilizing further recourses if shift duration is increased to 10 hrs.



Model view: Tutorial 3 Resource capacity validation

The screenshot displays the FlexSim software interface for a coffee processing plant simulation. The main workspace shows a 3D model with the following components and flow:

- Source:** The starting point of the material flow.
- Storage1:** A storage unit connected to the Source.
- Lathe:** A machine that processes material from Storage1.
- Storage2:** A storage unit connected to the Lathe.
- Drilling:** A machine that processes material from Storage2.
- Storage3:** A storage unit connected to the Drilling machine.
- Tapping:** A machine that processes material from Storage3.
- Storage4:** A storage unit connected to the Tapping machine.
- Milling:** A machine that processes material from Storage4.
- Storage5:** A storage unit connected to the Milling machine.
- Grinding:** A machine that processes material from Storage5.
- Sink1 Input: S1:** The final destination of the material flow.

The interface includes a top menu bar (File, Edit, View, Execute, Statistics, Debug, Help), a toolbar, and a left-hand library with categories such as Fixed Resources, Task Executors, and Travel Networks. A right-hand Properties panel is open, showing statistics for 'Sink1' (State: collecting, Throughput: 0.00) and a table of content and start time data.

Content	Cur	Min	Max	Avg
1.90	0.00	1.00	0.94	

Start time	Min	Max	Avg
8.80	0.00	0.00	0.00

At the bottom of the screen, the system tray shows the date and time: 8:13 PM, 6/4/2022.

Model view: Tutorial 3 Resource capacity validation

3.1 output from machine shop in 6Hr shift)

The screenshot displays a simulation software interface, likely FlexSim, showing a factory layout. The main workspace contains a grid with several components: a Source, Storage1, Process1, Storage2, Label, Storage3, Grinding, Process2, Tapping, Storage4, Milling, Process3, Storage5, and Sink Input 116. The interface includes a menu bar (File, Edit, View, Execute, Statistics, Debug, Help), a toolbar, and a status bar. A Properties panel on the right shows settings for the selected component, including Name, Throughput, Content, and Status. A Library panel on the left lists various components like Fixed Resources, Task Executors, and Conveyors. A bottom status bar shows the current view and scale.

Content	Cur	Min	Max	Kg
1.00	0.00	1.00	0.99	

Min	Max	kg
0.00	0.01	0.01

x	y	z
21.51	21.47	0.00
0.00	0.00	0.00
1.08	1.08	0.10

Model view: Tutorial 3 Resource capacity validation

3.2 Stay time at each inventory station

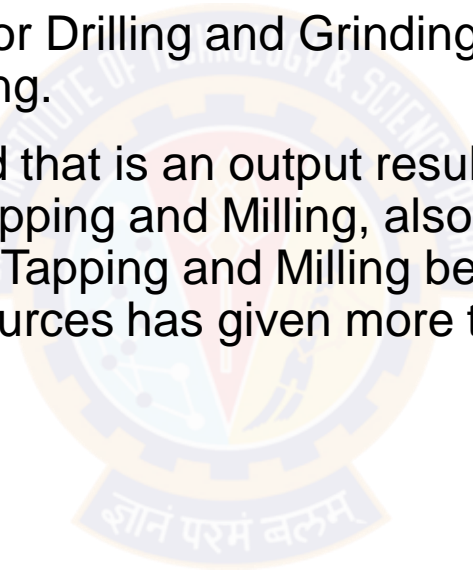
The screenshot displays the FlexSim 2020 for Education interface. The main window shows a 3D model of a manufacturing process with the following components: Source, Storage1, Lathe, Storage2, Drilling, Storage3, Tapping, Storage4, Milling, Storage5, Grinding, and Sink1. The process flow is linear, starting from the Source and ending at Sink1, with inventory stations (Storage1-5) located between processing stations (Lathe, Drilling, Tapping, Milling, Grinding).

A dashboard window titled "Staytime Histogram" is open, showing a bar chart of staytime distribution for five storage stations. The x-axis represents staytime in minutes, with major ticks at 0.00, 23.20, 46.40, 69.61, and 92.81. The y-axis represents frequency, ranging from 0 to 120. The legend indicates the following color coding for the storage stations: Storage1 (blue), Storage2 (orange), Storage3 (green), Storage4 (red), and Storage5 (purple). Storage1 shows the highest frequency of items, with a peak around 10 minutes. Storage5 shows a significant peak around 20 minutes.

The interface also includes a Library on the left with various content and output options, and a Properties panel on the right for the dashboard. The bottom status bar shows the mouse position at [-9.27, -20.22, 0.00] and the system time as 9:21 PM on 9/4/2022.

Comparison remarks

- In first case 3.1 When the model has run for 6hrs an output we got at sink is 56.
- And in 3.2 The stay time is very high for lathe that is 77.68 minutes then next for tapping 35 minutes and in milling 28.5 minutes. For Drilling and Grinding the staytime is very less when compared with lathe, tapping and milling.
- In 3.3 the production has been doubled that is an output resulted at sink is 115 by adding resources such as one more Lathe ,Tapping and Milling, also increased shift duration to 10hrs . Here we have added one more Lathe ,Tapping and Milling because these three processors had more staytime so by adding extra resources has given more throughput.



Model view: Tutorial 4 Daily Inventory analysis

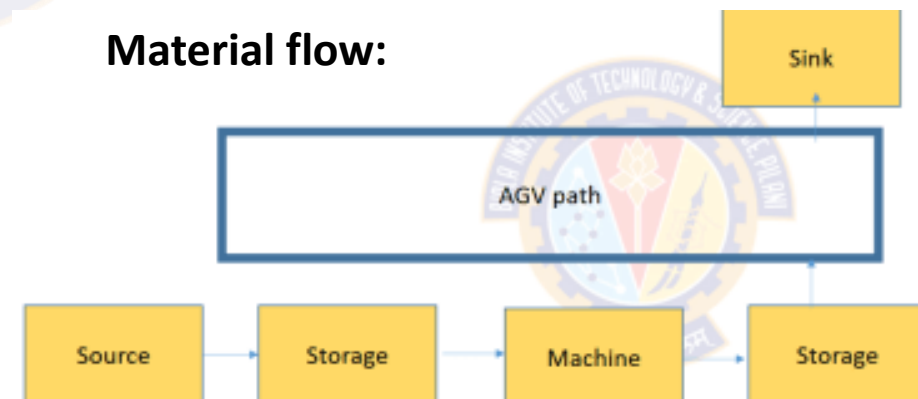
A plant uses AGV for handling a product across two production floor. Use the following resources and run the simulation model for one day. Company works in double shift, each shift runs for 8 hours. The shop floor manager wants to find out the inventory accumulation at the end of each day.

Task exe./ Resources	Parameters
Product	Input is unlimited, interarrival time is 3 min
AGV	Qty. 1, Loading and unloading time 0 min. Max speed 60m/min Capacity, 3 parts at a time
Sink	output

Find,

1. WIP
2. Stay time at storage
3. Total parts arrived and dispatched

Material flow:



Model view: Tutorial 4 Daily Inventory analysis

4.1 Work In Progress

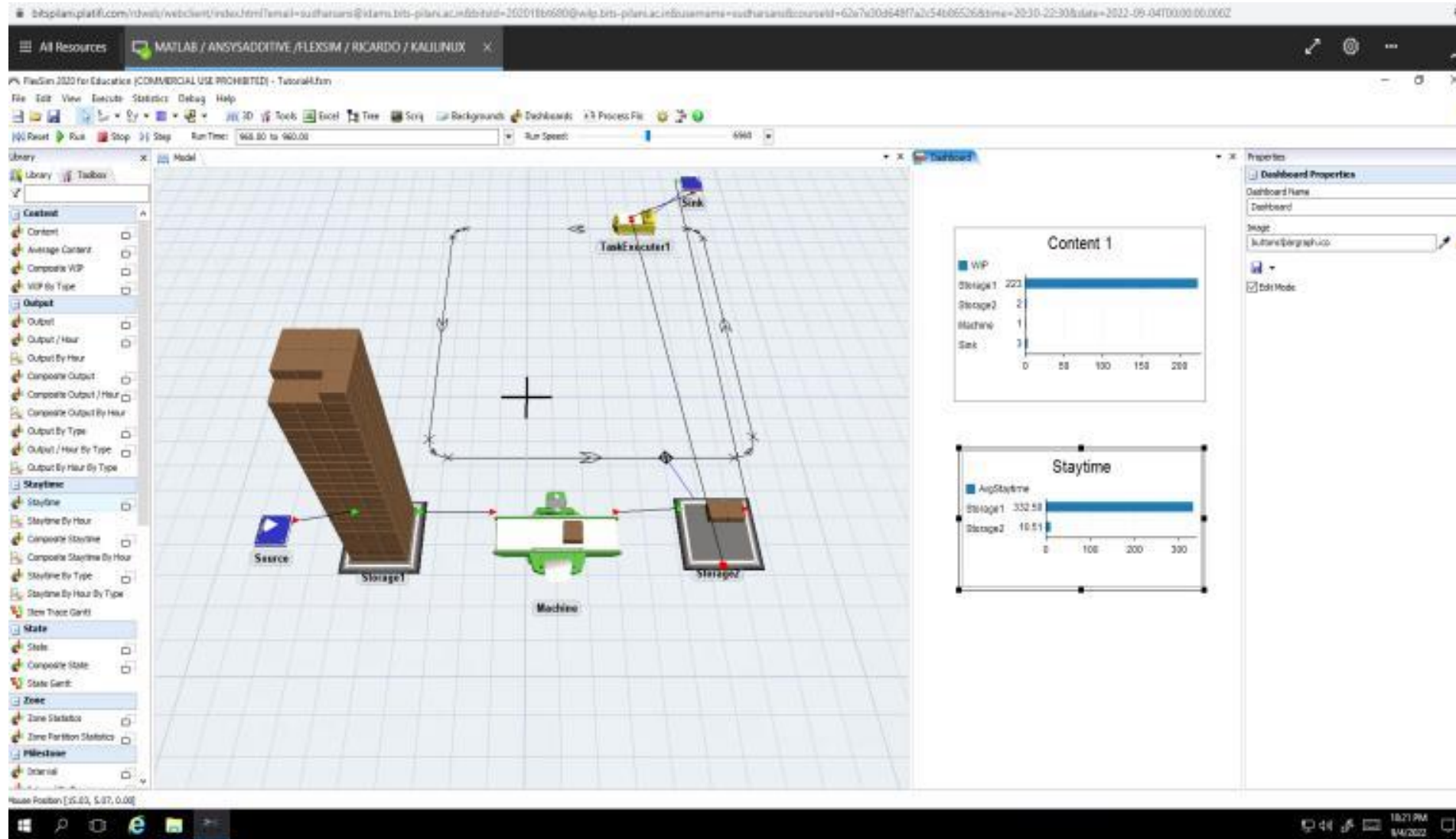
The screenshot displays a simulation software interface with a 3D model of a production line and a data table. The 3D model shows a 'Source' block connected to 'Storage1', which is connected to a 'Machine' block, which is connected to 'Storage2', and finally to a 'Sink' block. A 'TaskExecutor1' block is also connected to the 'Sink' block. The data table, titled 'Content 1', shows the following values:

Item	Value
SIP	223
Storage1	0
Storage2	1
Machine	3
Sink	0

The interface also includes a 'Properties' panel on the right with various settings for the selected object, and a 'Library' panel on the left with various simulation components.

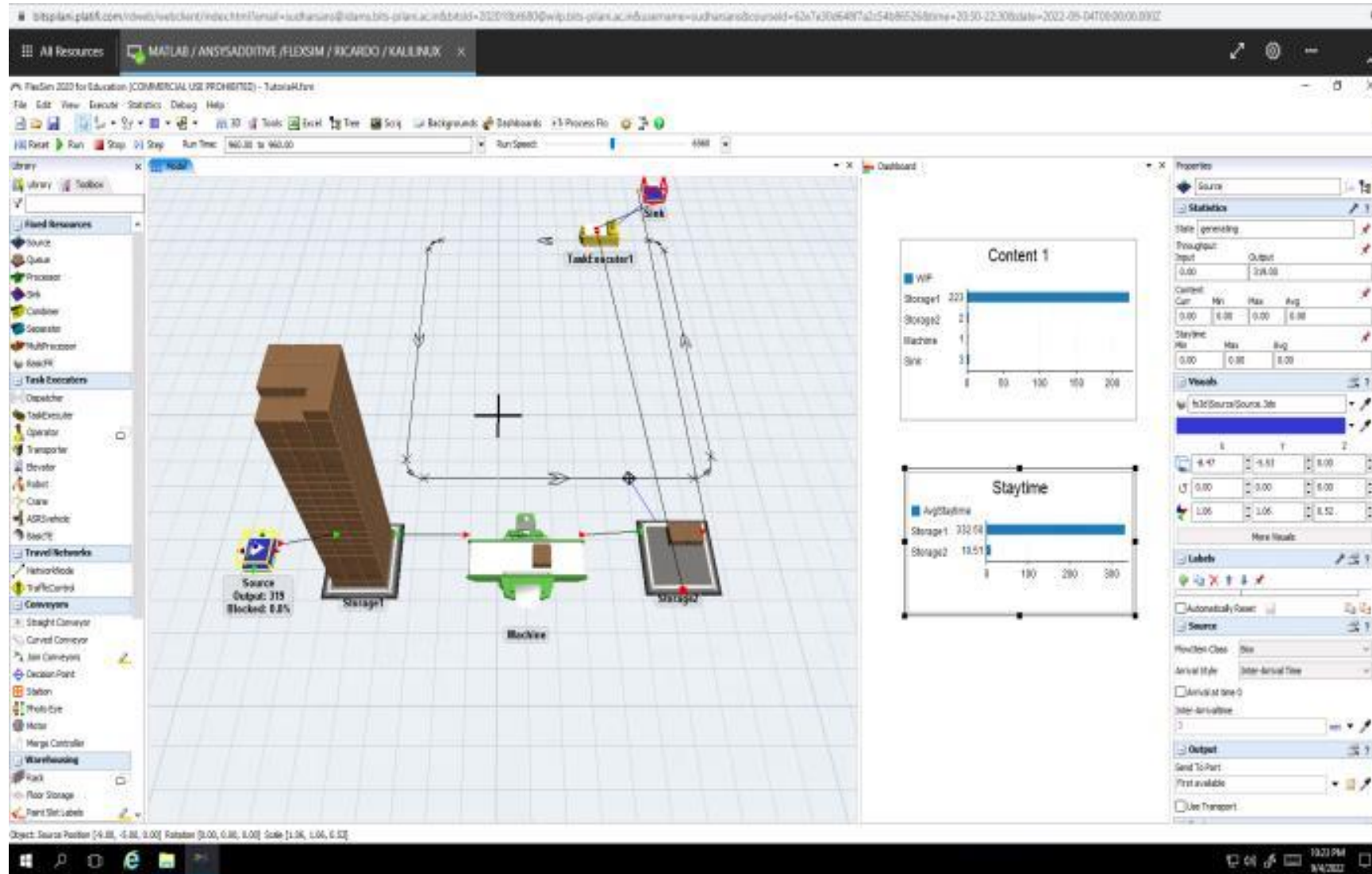
Model view: Tutorial 4 Daily Inventory analysis

4.2 Staytime at storage



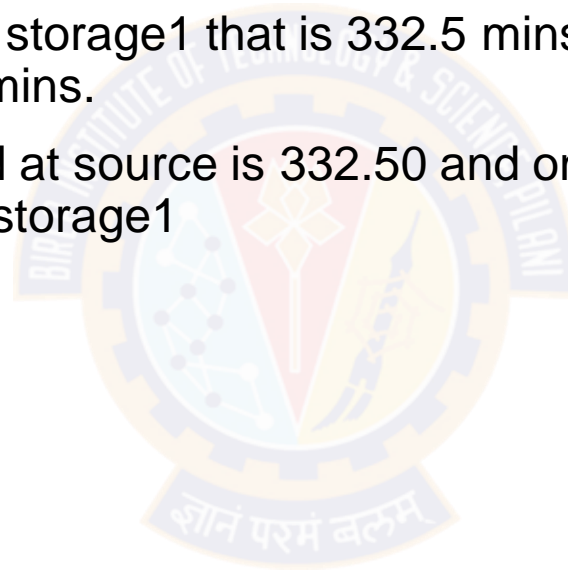
Model view: Tutorial 4 Daily Inventory analysis

4.3 Parts Arrived



Comparison Remarks

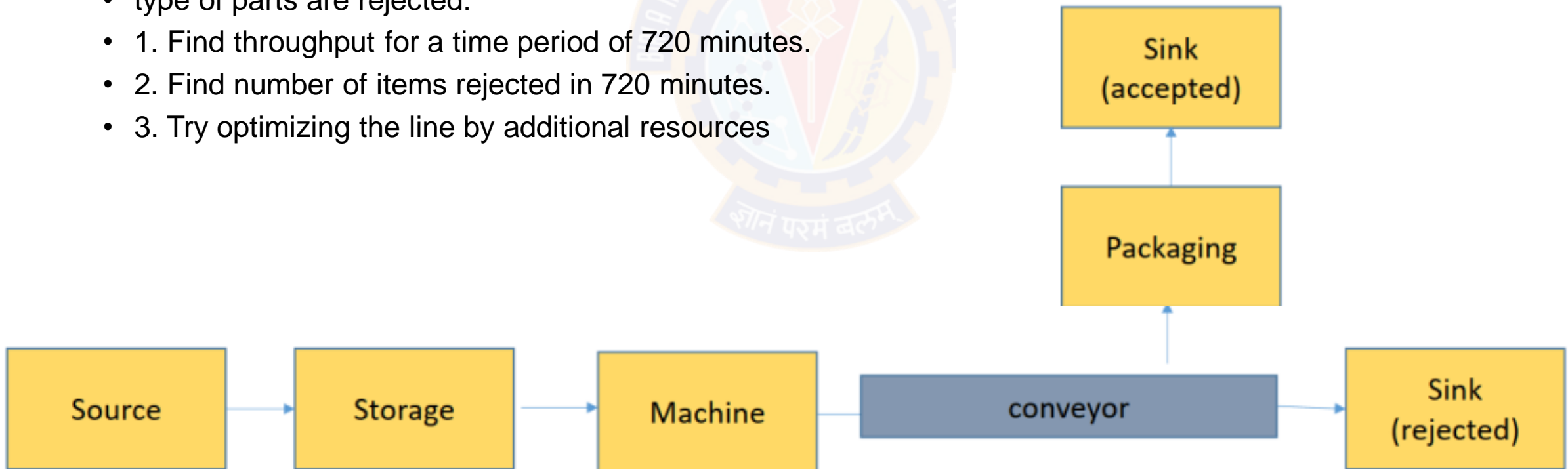
- In 4.1 the model has been running for double shift (ie.16hrs) WIP at storage 1 is very high that is 223 when compared with Storage2 (2) , In machine (1)and in sink (3 products).
- In 4.2 The stay time is very high at storage1 that is 332.5 mins when compared with storage2 which is having stay time of 10.78mins.
- In 4.3 the product has been arrived at source is 332.50 and only 10.51 items were dispatched at sink because of more stay time at storage1



Model view: Tutorial 5 Equipment Performance Validation

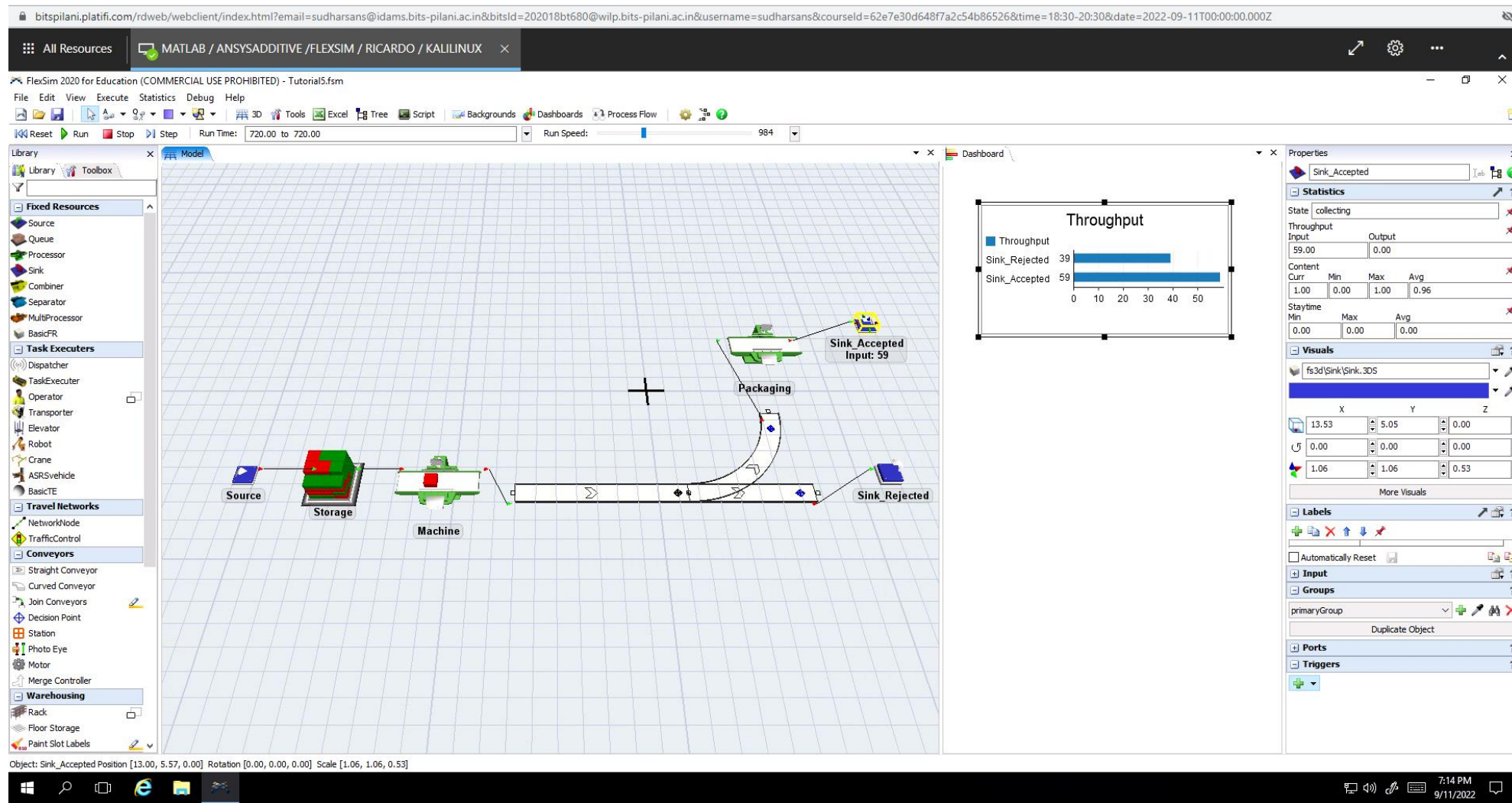
A conveyor systems supplier company proposed a design of a conveyor system. The buying company wants to see its simulation before purchasing it. Parts arrive in the quality testing shop floor following an exponential distribution (0,5,0) minutes. They want to see the overall throughput of the proposed conveyor design for a time period of 720 minutes. There are mainly two kind of parts to be sorted by the system. The testing station takes 7 min to check each part, which is further connected to the proposed conveyor system. 1st type of parts are processed on a machine with processing time 2 minutes while the 2nd

- type of parts are rejected.
- 1. Find throughput for a time period of 720 minutes.
- 2. Find number of items rejected in 720 minutes.
- 3. Try optimizing the line by additional resources



Model view: Tutorial 5 Equipment Performance Validation

5.1 Throughput and Number of items Rejected



Model view: Tutorial 5 Equipment Performance Validation

5.2 Optimize the line by adding one more testing Machine

The screenshot displays the FlexSim 2020 for Education interface. The main workspace shows a simulation model of a production line. The model consists of the following components:

- Source:** A blue cube representing the material source.
- Storage:** A red and green cube representing a storage area.
- Machine:** A green and white machine representing the primary processing unit.
- Packaging:** A curved conveyor belt leading to a green and white machine representing a packaging station.
- Sink Accepted:** A blue cube representing the final destination for accepted products.
- Sink Rejected:** A yellow cube representing the final destination for rejected products, with an input of 39.

The **Dashboard** window shows a **Throughput** bar chart with the following data:

Category	Throughput
Sink_Rejected	39
Sink_Accepted	59

The **Properties** window for the **Sink_Rejected** object shows the following statistics:

Property	Value
State	collecting
Throughput Input	39.00
Throughput Output	0.00
Content Curr	1.00
Content Min	0.00
Content Max	1.00
Content Avg	0.94
Staytime Min	0.00
Staytime Max	0.00
Staytime Avg	0.00

The **Visuals** window shows the 3D coordinates for the Sink_Rejected object:

Property	X	Y	Z
fs3d Sink Sink_3DS	11.53	-5.53	0.00
Origin	0.00	0.00	0.00
Scale	1.06	1.06	1.25

The **Labels** window shows the following properties:

- Input:** primaryGroup
- Ports:** ?
- Triggers:** ?

The status bar at the bottom indicates the object's position and rotation: Object: Sink_Rejected Position [11.00, -5.00, 0.00] Rotation [0.00, 0.00, 0.00] Scale [1.06, 1.06, 1.25].

Model view: Tutorial 5 Equipment Performance Validation

5.3 Optimized Throughput at Sink_Accepted

The screenshot displays the FlexSim 2020 interface for a simulation model. The main workspace shows a 3D model of a production line with components: Source, Storage, TESTING STATION 1, TESTING STATION 2, Packaging, Sink_Accepted (Input: 74), and Sink_Rejected. A dashboard window titled 'Throughput' shows a bar chart comparing the throughput of Sink_Rejected (64) and Sink_Accepted (74). The Properties panel on the right provides detailed statistics for the Sink_Accepted object.

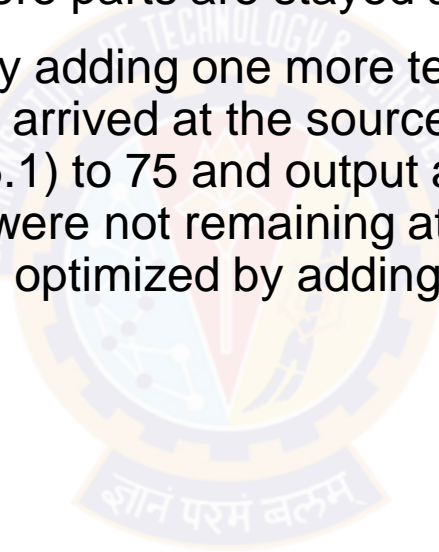
Category	Value
Sink_Rejected	64
Sink_Accepted	74

Property	Value
State	collecting
Throughput Input	74.00
Throughput Output	0.00
Content Curr	1.00
Content Min	0.00
Content Max	1.00
Content Avg	0.96
Staytime Min	0.00
Staytime Max	0.00
Staytime Avg	0.00

Object: Sink_Accepted Position [13.00, 5.57, 0.00] Rotation [0.00, 0.00, 0.00] Scale [1.06, 1.06, 0.53]

Comparison Remarks

- (In 5.1) when the model has been running for 720 mins and The number of 1st type of parts accepted at sink_accepted were 59 and {in 5.2} number of 2nd type of parts rejected at sink_rejected were 39 where some more parts are stayed at storage.
- (In 5.3) The line has been optimized by adding one more testing station in the line and run the model for 720 mins resulted that parts arrived at the source was 141 and parts accepted at sink_accepted is increased from 59(5.1) to 75 and output at sink_rejected is increased from 39 (5.2)to 64 and there is no more parts were not remaining at storage. All parts has been transferred to sink.) The line has been optimized by adding one more testing station



Model view: Tutorial 6 Predictive Maintenance

In a shop floor,

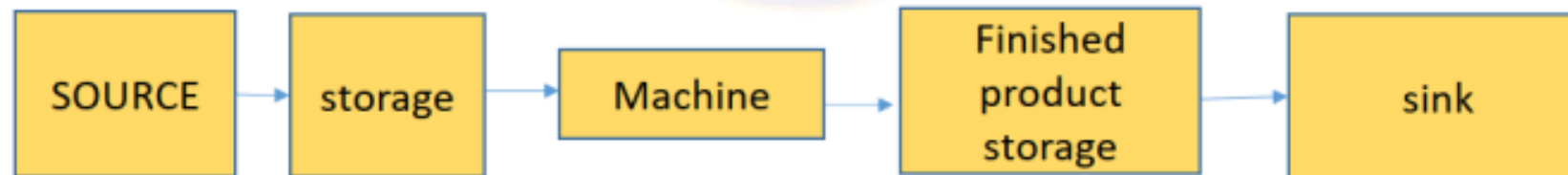
Arrival rate of shipment is exponential distribution of (0,5,0) min

The setup time is described by the triangular distribution of minimum 1.5min, max 4.5 min and most commonly 2.5min.

The processing time is described using lognormal (mean std deviation) distribution with mean of 10 and standard deviation of 3.

There are 20% chances that the parts will be reworked after processing and be sent back to the queue.

Find throughput of the shop by rework status for 12hr duration.



Model view: Tutorial 6 Predictive Maintenance

6.1 To Find throughput of the shop by Rework Status for 12hrs duration

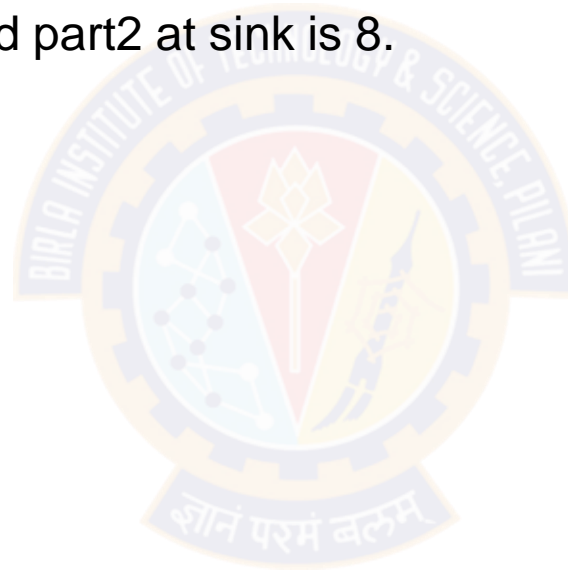
The screenshot displays the FlexSim 2020 interface. The main 3D model shows a production line with the following components: Source, Storage, Machine, Finished Product Storage, and Sink. The dashboard on the right contains a table titled "Output By Type" with the following data:

Type	Throughput
1	45
2	8

The interface also includes a left-hand library with categories like Fixed Resources, Task Executors, Travel Networks, Conveyors, and Warehousing. The bottom status bar shows the mouse position as [-10.29, -14.51, 0.00] and the system time as 8:00 PM on 9/11/2022.

Comparison Remarks

- In this tutorial 6 after running the model for 12hrs 45 part1 items reached sink and 8 items has been sent back to queue and reworked then sent to sink as part2 .
- So Resulted part 1 at sink is 45 and part2 at sink is 8.



Model view: Tutorial 7

In a shop floor inventory moves as indicated. The breakdown of the machines is having a significant impact on the throughput. An operator is appointed for maintenance activity and the same is carrying products, from storage 3 to sink.

1. Find throughput in 480 min of run time.
2. Find change in output if two operators are employed for maintenance and forklift is employed at storage 3.

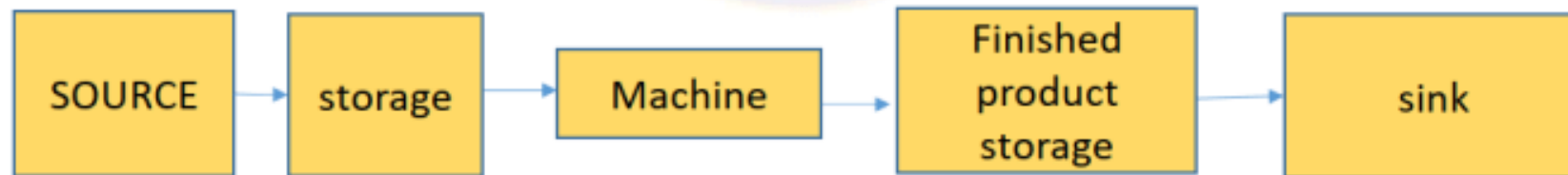
Use following specifications:

Conveyor speed, 10 m/min

Operator speed, 5 m/min

Processing time, 5 min

Failure occurs in 30 min, up time 20 min, down time 5 min.



Model view: Tutorial 7

7.1 To find throughput in 480 mins of Run Model

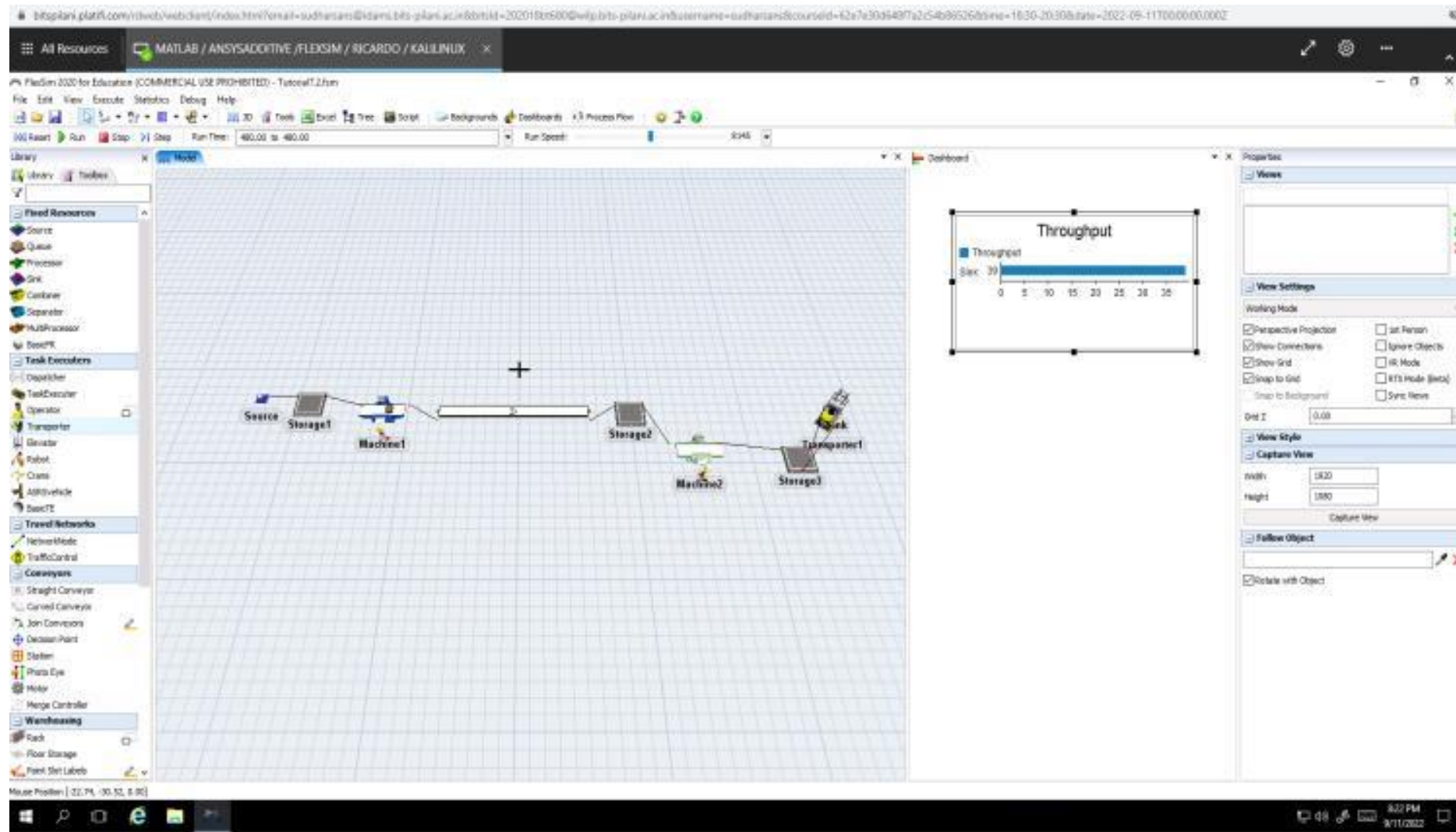
The screenshot displays the FlexSim 2020 software interface. The main window shows a simulation model with the following components: Source, Storage1, Machine1, Operator2, Machine2, Storage2, Storage3, and Sink. A plus sign (+) is positioned above the flow between Machine1 and Operator2. The Run Time is set to 480.00 to 480.00, and the Run Speed is 1678.

On the right side, a Dashboard window is open, titled "Throughput". It features a horizontal bar chart showing the throughput at the Sink, which is currently at 35. The x-axis ranges from 0 to 35 with increments of 5. The Properties panel on the far right shows the "Dashboard Properties" for this dashboard, including the name "Throughput" and the image path "buttons\bargraph.ico".

The left sidebar contains a Library with various output and state monitoring options, such as "Output", "Staytime", "State", and "Zone".

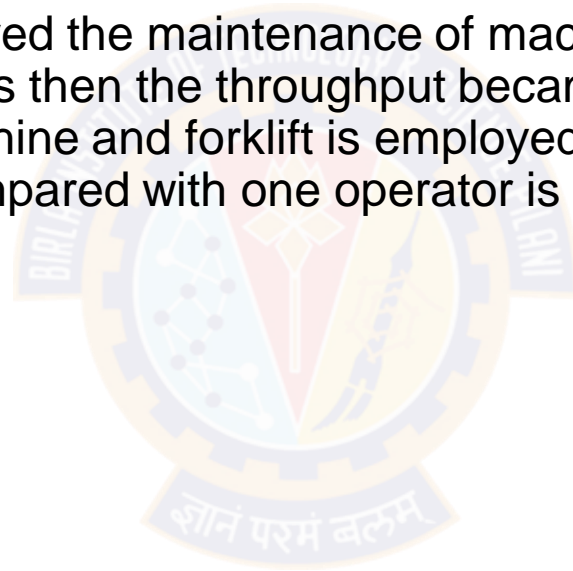
Model view: Tutorial 7

7.2 Throughput change in output if two operators employed for maintenance and forklift is employed at storage 3



Comparison Remarks

- In 7.1 When one operator is involved in both machines maintenance and carrying products from storage 3 to sink for 480 mins the throughput resulted at sink is 38.
- In 7.2 While Two operators employed the maintenance of machines separately and a forklift is employed at storage 3 for 480 mins then the throughput became 39 . If two operators are involved for maintaining each machine and forklift is employed at storage 3 (7.2) means the throughput is increased when compared with one operator is involved (7.1) to employ all these.



Model view: Tutorial 8 SHOP FLOOR MANAGEMENT

Raw material arrival station and finished product shipping points are at opposite end of a 75m long shop floor. Raw materials are arriving every 2 min. it is processed by 3 parallel machines with machining time 5 minutes each. One transporter carries the items from arrival station to storage and three operators carries them to individual machines. Automated conveyor system takes the finished products to the finished part storage. Further a transporter carries the finished products to the shipping point as bunch of 5 parts at a time.

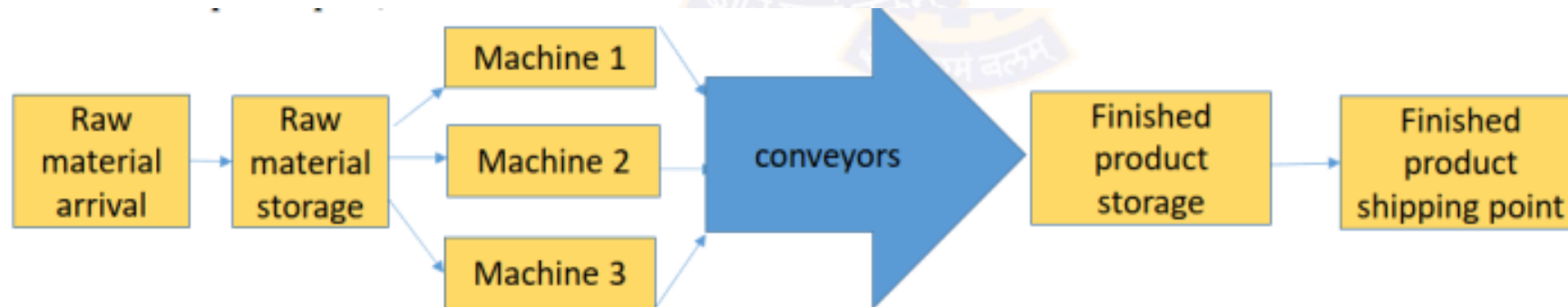
1. Arrange the resources on the shop floor and calculate throughput for a trial period of 12 hrs.
2. Compare the output if only 2 machines are operational.

Use following specifications:

Conveyor speed, 10 m/min

Operator speed, 5 m/min

transporter speed, 60 m/min



Model view: Tutorial 8 SHOP FLOOR MANAGEMENT

8.1 Arrangement of resources on the shop floor and calculate throughput for a trial period of 12 hrs

bitspilani.platifi.com/rdweb/webclient/index.html?email=sudharsans@idams.bits-pilani.ac.in&bitsId=202018bt680@wilp.bits-pilani.ac.in&username=sudharsans&courseId=62e7e30d648f7a2c54b86526&time=20:30-22:30&date=2022-09-13T00:00:00.000Z

All Resources | MATLAB / ANSYSADDITIVE / FLEXSIM / RICARDO / KALINUX

FlexSim 2020 for Education (COMMERCIAL USE PROHIBITED) - Tutorial8.fsm

File Edit View Execute Statistics Debug Help

Reset Run Stop Step Run Time: 720.00 to 720.00 Run Speed: 10825

Library | Model | Dashboard | Properties

Library | Toolbox

Fixed Resources

- Source
- Queue
- Processor
- Sink
- Combiner
- Separator
- Multiprocessor
- BasicFR

Task Executors

- Dispatcher
- TaskExecutor
- Operator
- Transporter
- Elevator
- Robot
- Crane
- ASRSVehicle
- BasicTE

Travel Networks

- NetworkNode
- TrafficControl

Conveyors

- Straight Conveyor
- Curved Conveyor
- Join Conveyors
- Decision Point
- Station
- Photo Eye
- Motor
- Merge Controller

Warehousing

- Rack
- Floor Storage
- Paint Slot Labels

Raw Material Arrival

Machine1

Machine2

Machine3

Dispatcher1

Operator1

Operator2

Operator3

Operator4

Finished Product Storage

Finished product shipping point

Output

Object	Throughput
Finished product shipping point	230

Properties

Views

View Settings

Working Mode

- Perspective Projection
- 1st Person
- Show Connections
- Ignore Objects
- Show Grid
- VR Mode
- Snap to Grid
- RTX Mode (Beta)
- Snap to Background
- Sync Views

Grid Z: 0.00

View Style

Capture View

Width: 1920

Height: 1080

Capture View

Follow Object

- Rotate with Object

Mouse Position [1.72, -37.72, 0.00]

9:48 PM 9/13/2022

Model view: Tutorial 8 SHOP FLOOR MANAGEMENT

8.2 Only two machines are operational

bitspilani.platifi.com/rdweb/webclient/index.html?email=sudharsans@idams.bits-pilani.ac.in&bitsId=202018b680@wilp.bits-pilani.ac.in&username=sudharsans&courseId=62e7e30d648f7a2c54b86526&time=20:30-22:30&date=2022-09-13T00:00:00.000Z

FlexSim 2020 for Education (COMMERCIAL USE PROHIBITED) - Tutorial8.fsm

File Edit View Execute Statistics Debug Help

Reset Run Stop Step Run Time: 720.00 to 720.00 Run Speed: 19389

Library

- Fixed Resources
 - Source
 - Queue
 - Processor
 - Sink
 - Combiner
 - Separator
 - MultiProcessor
 - BasicFR
- Task Executors
 - Dispatcher
 - TaskExecutor
 - Operator
 - Transporter
 - Elevator
 - Robot
 - Crane
 - ASRSvehicle
 - BasicTE
- Travel Networks
 - NetworkNode
 - TrafficControl
- Conveyors
 - Straight Conveyor
 - Curved Conveyor
 - Join Conveyors
 - Decision Point
 - Station
 - Photo Eye
 - Motor
 - Merge Controller
- Warehousing
 - Rack
 - Floor Storage
 - Paint Slot Labels

Model

Raw Material Arrival

Dispatcher1

Machine1

Machine2

Finished Product Storage

Finished product shipping point

Dashboard

Object	Throughput
Finished product shipping point	170

Properties

Views

View Settings

Working Mode

- Perspective Projection
- Show Connections
- Show Grid
- Snap to Grid
- Snap to Background
- Grid Z: 0.00
- 1st Person
- Ignore Objects
- VR Mode
- RTX Mode (Beta)
- Sync Views

View Style

Capture View

Width: 1920

Height: 1080

Follow Object

- Rotate with Object

Mouse Position [-10.89, 13.58, 0.00]

9:38 PM 9/13/2022

Comparison remarks

- In 8.1 the model has been running for 12hrs with all three machines are operational has given the output at finished product shipping point is 210 products.
- In 8.2 Only two machines are operational and the model has run for 12 hrs period has been giving an output at finished product shipping point is 170 products.
- The output of two machines are operational(8.2) is less than the output of three machines are operational (8.1) . When compare the output of 8.1 with 8.2, the output of 8.2 is less than 8.1. When the machines are changed from three machines to two machines then the output got reduced from 210 to 155

