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FlexSim Tutorial practice submission

NAME : SUDHARSAN SIVALINGAM
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

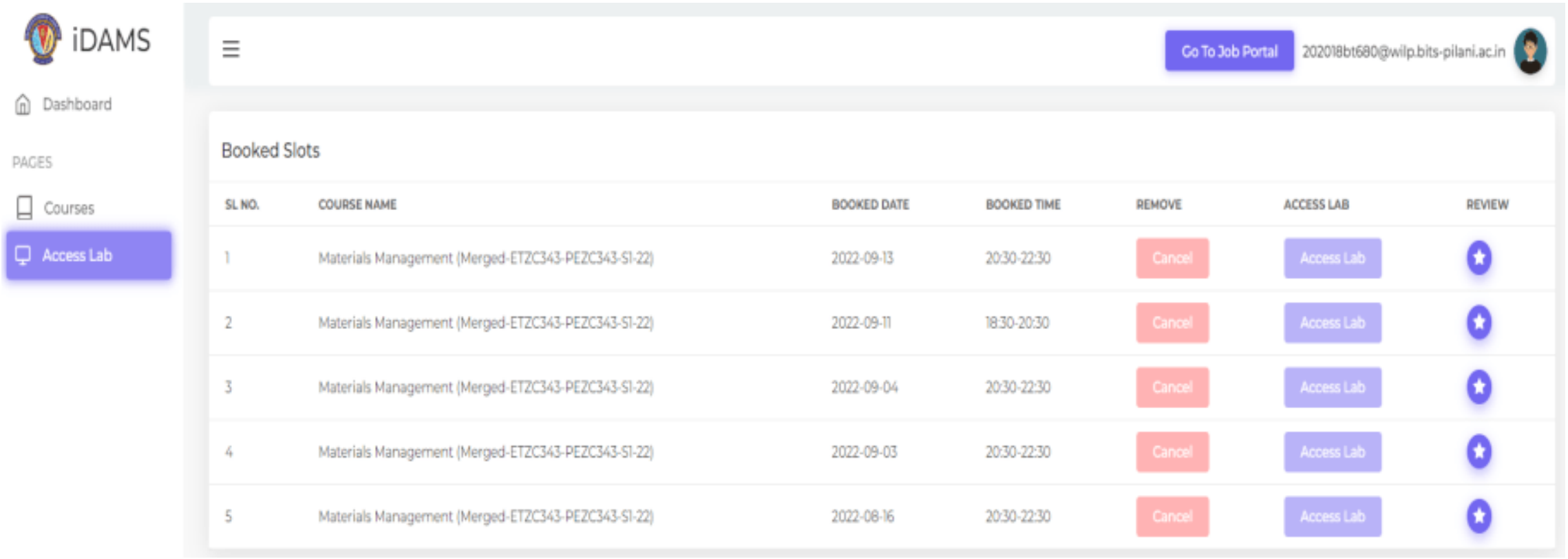
HALL TICKET FOR EC2 EC2 REGULAR

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

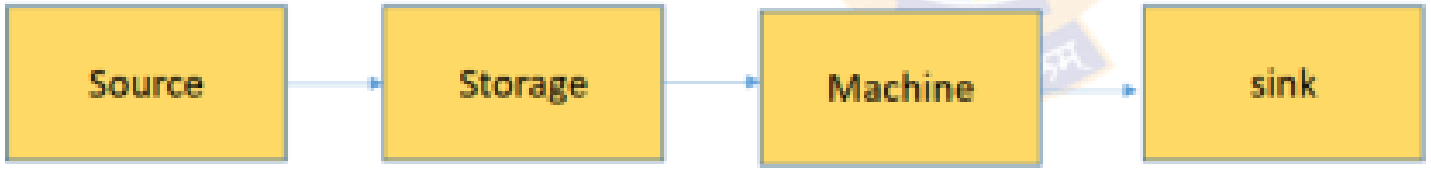


Model view: Tutorial 1 Output comparison: Basic model

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,

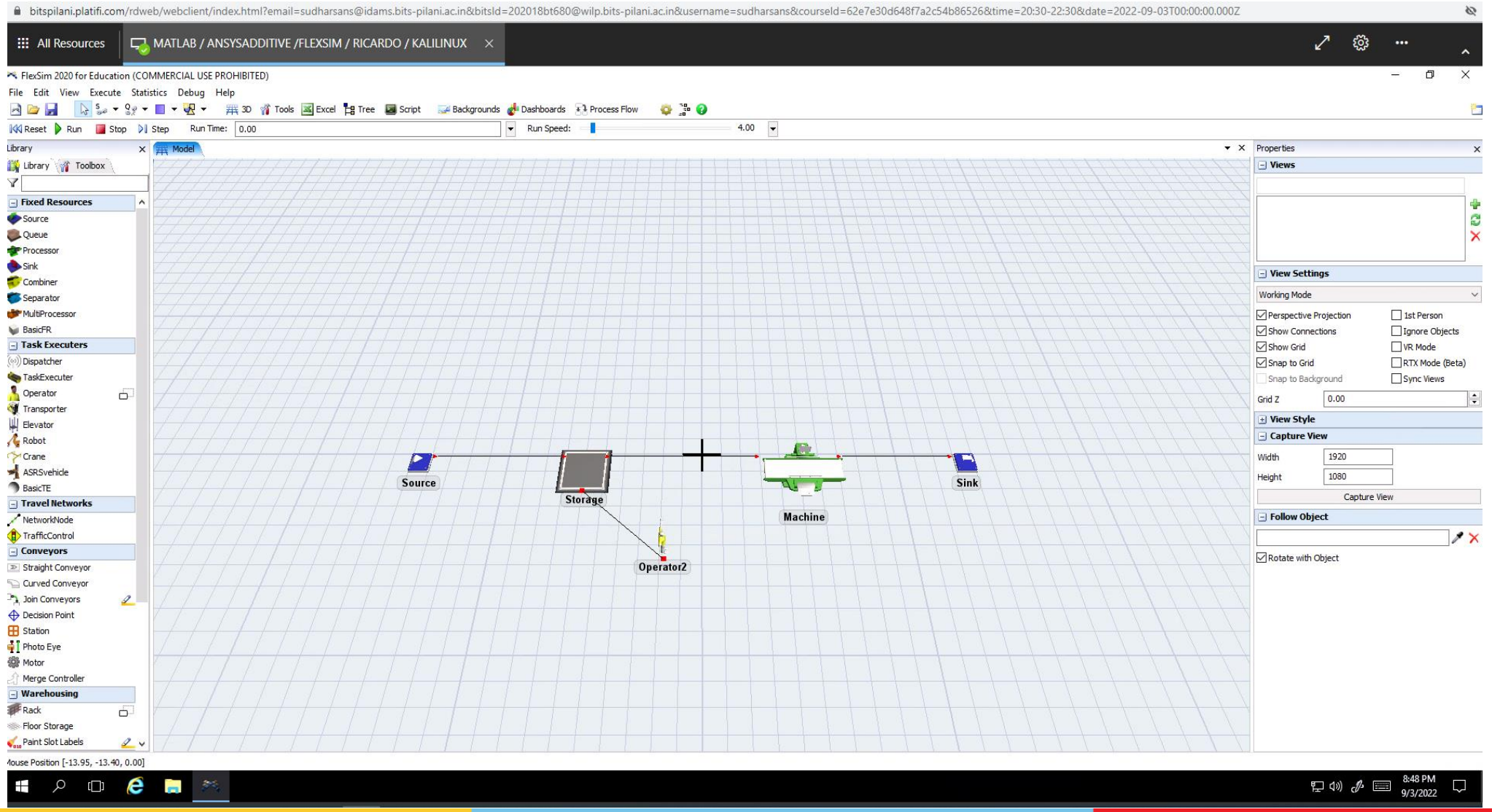
1. One operator is involved in transferring the product from storage to machine
2. Same operator is taking the product from storage to sink
3. Different operators are involved to carry products on the either side of the machine.

Material flow:



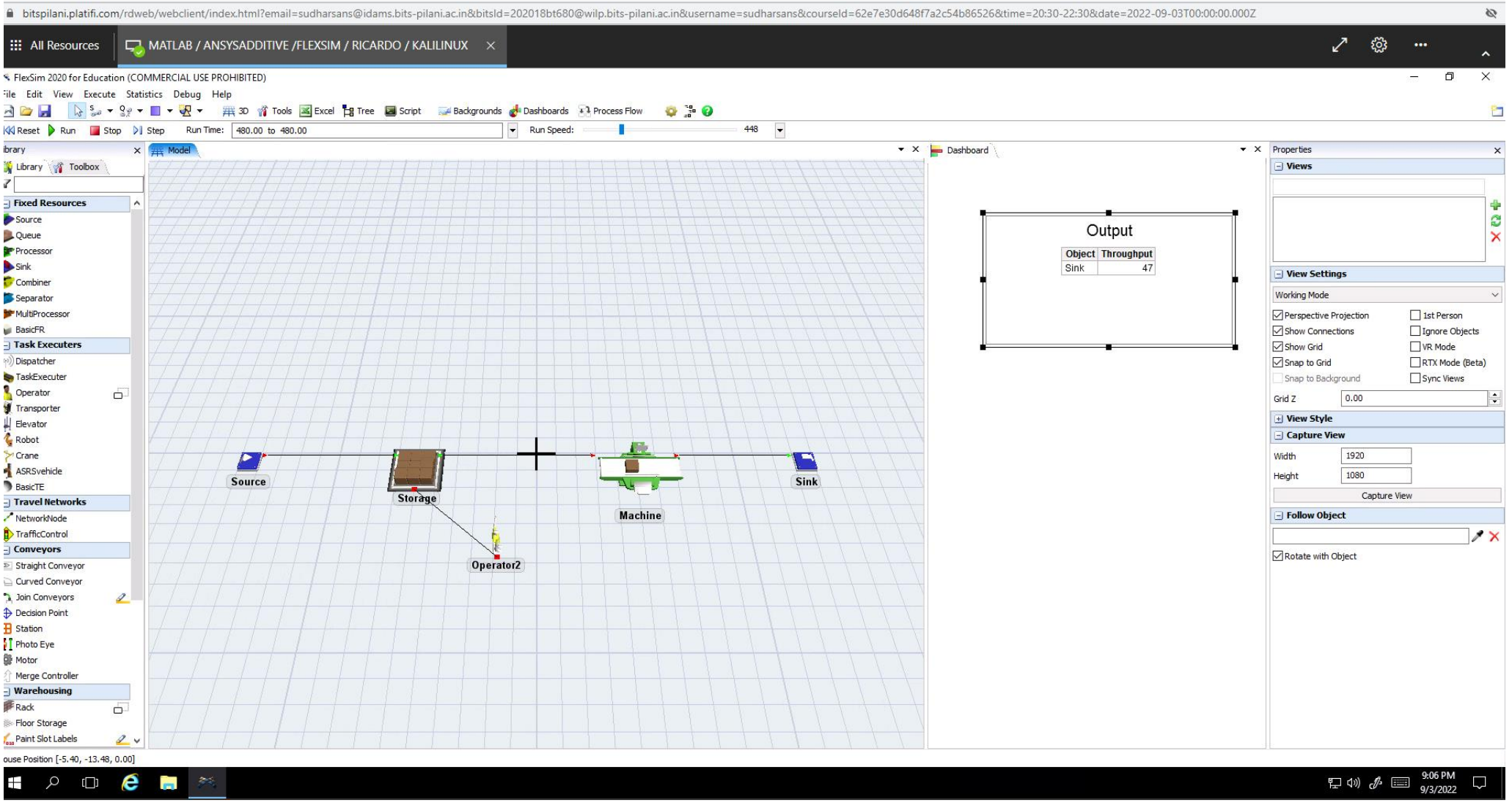
Model view: Tutorial 1 Output comparison: Basic model

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



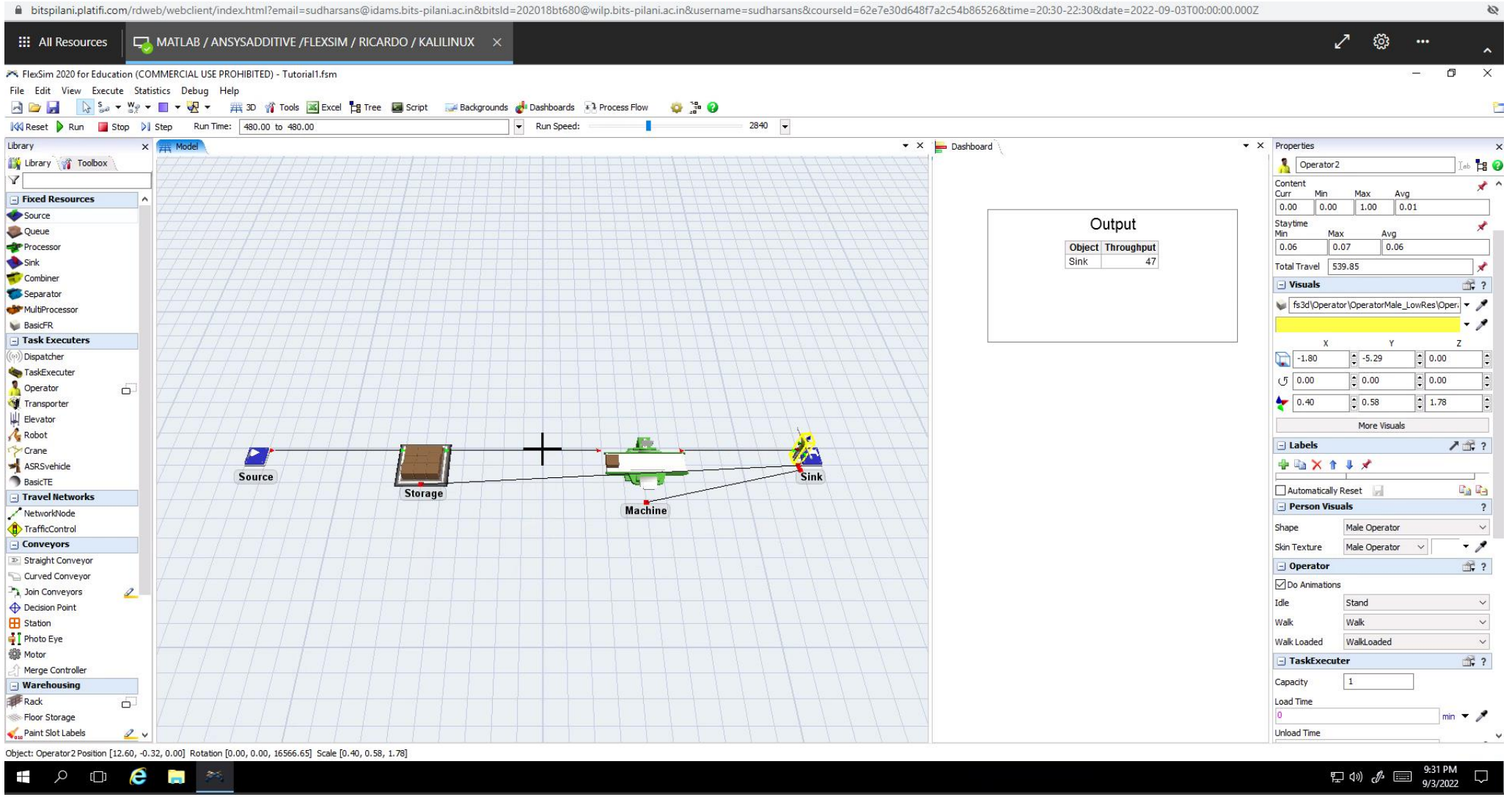
Model view: Tutorial 1 Output comparison: Basic model

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



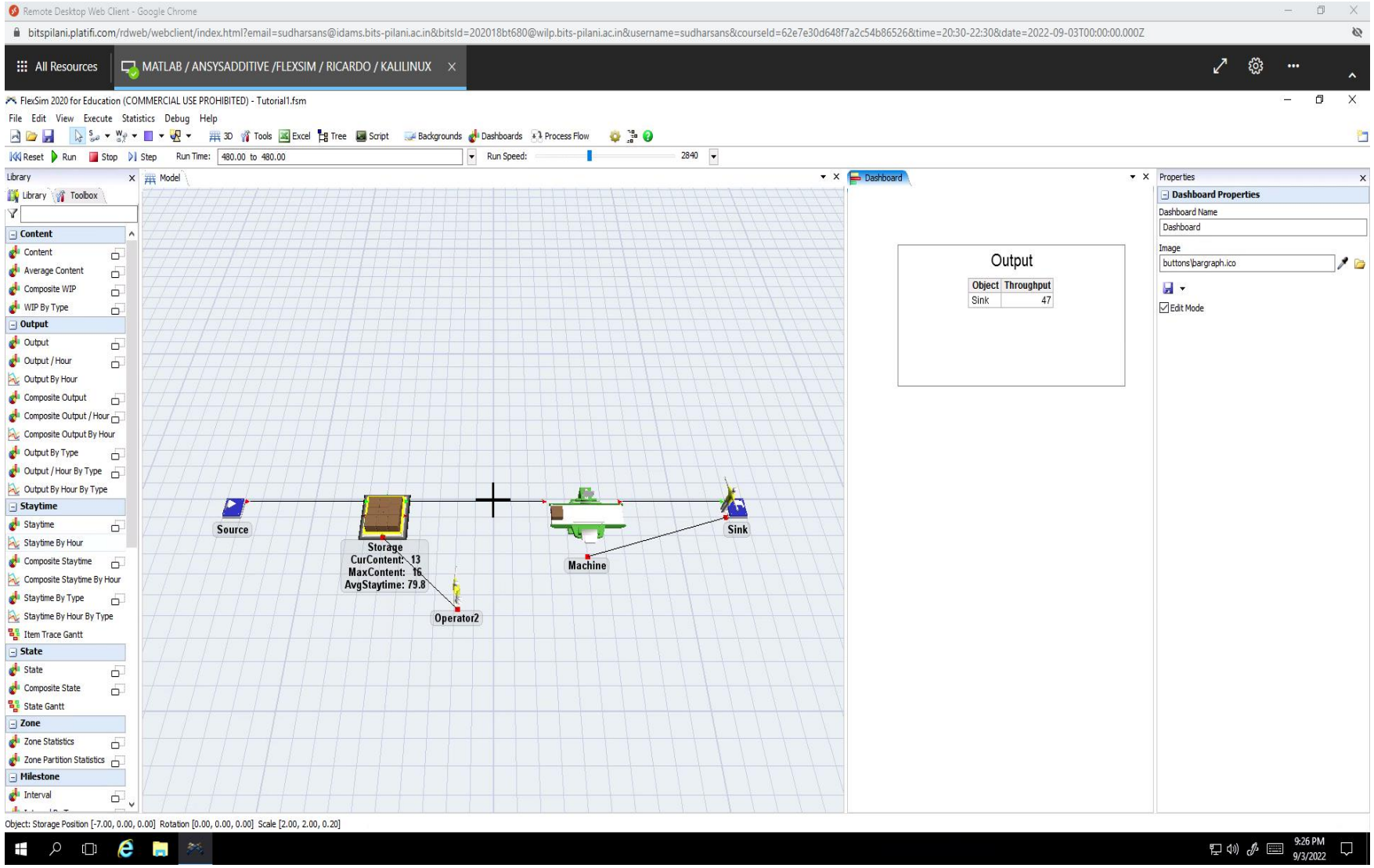
Model view: Tutorial 1 Output comparison: Basic model

1.2 Same operator is taking the product from storage to sink



Model view: Tutorial 1 Output comparison: Basic model

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



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.

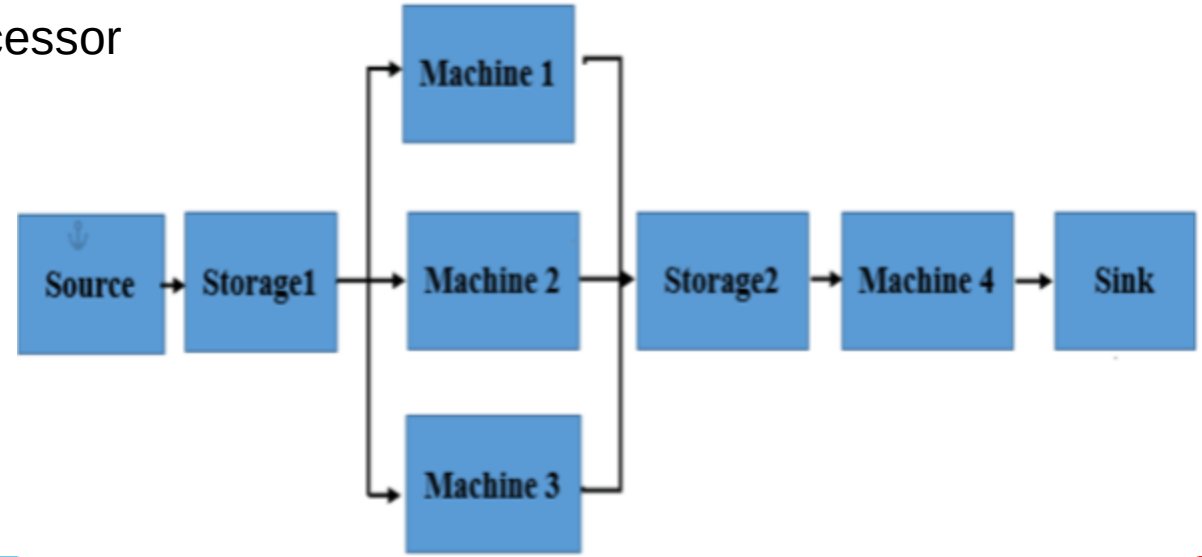
Model view: Tutorial 2 Throughput Estimation

A shop floor inside a tractor manufacturing company manufactures mainly three different products. The parts enters 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.

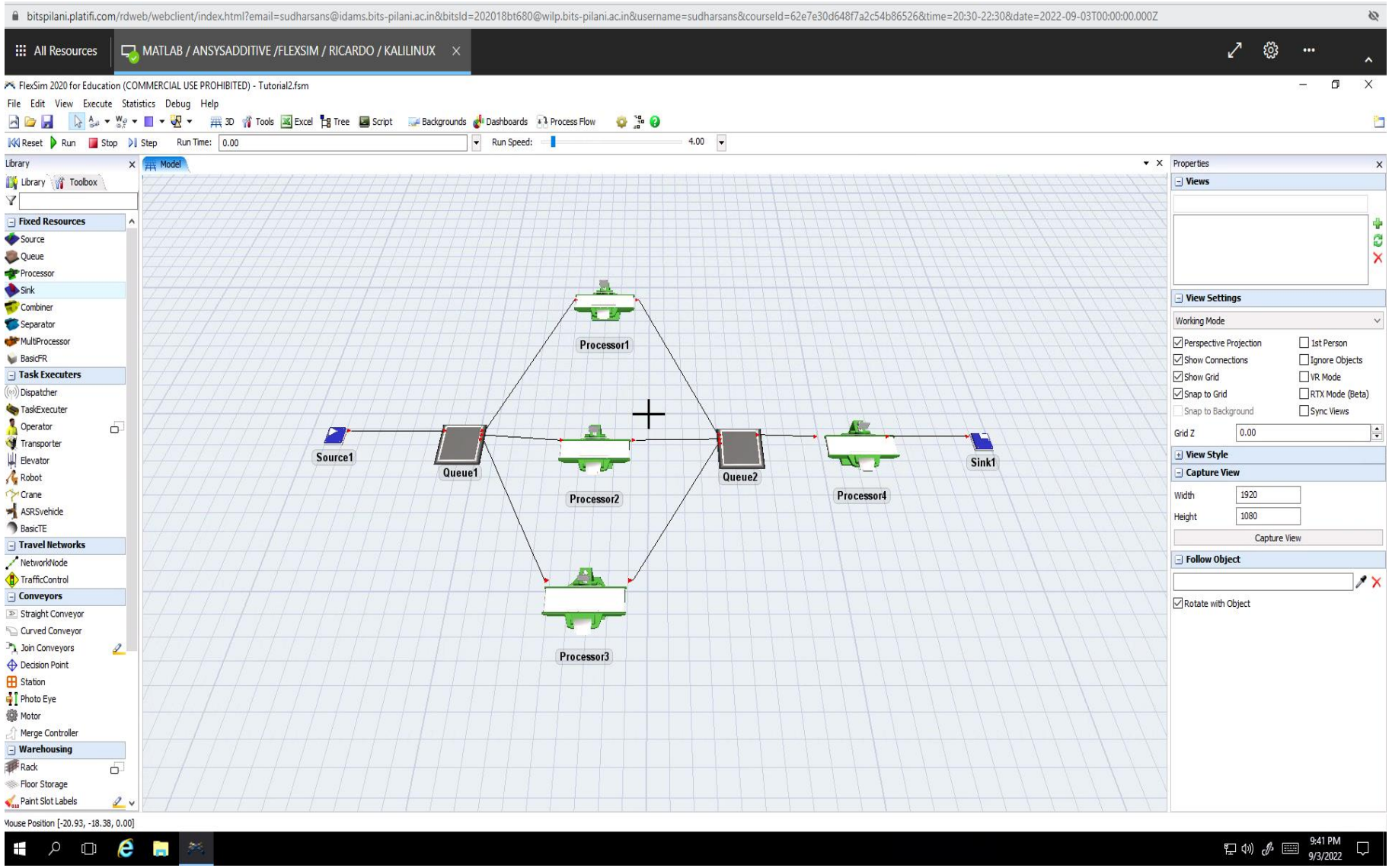
1. Report the average waiting time at the raw material inventory
2. Analyze the impact of material transport using operators on the production throughput by:
   2.1 Adding operator for all three processor
   2.2 No transport for all the processor

Material flow:



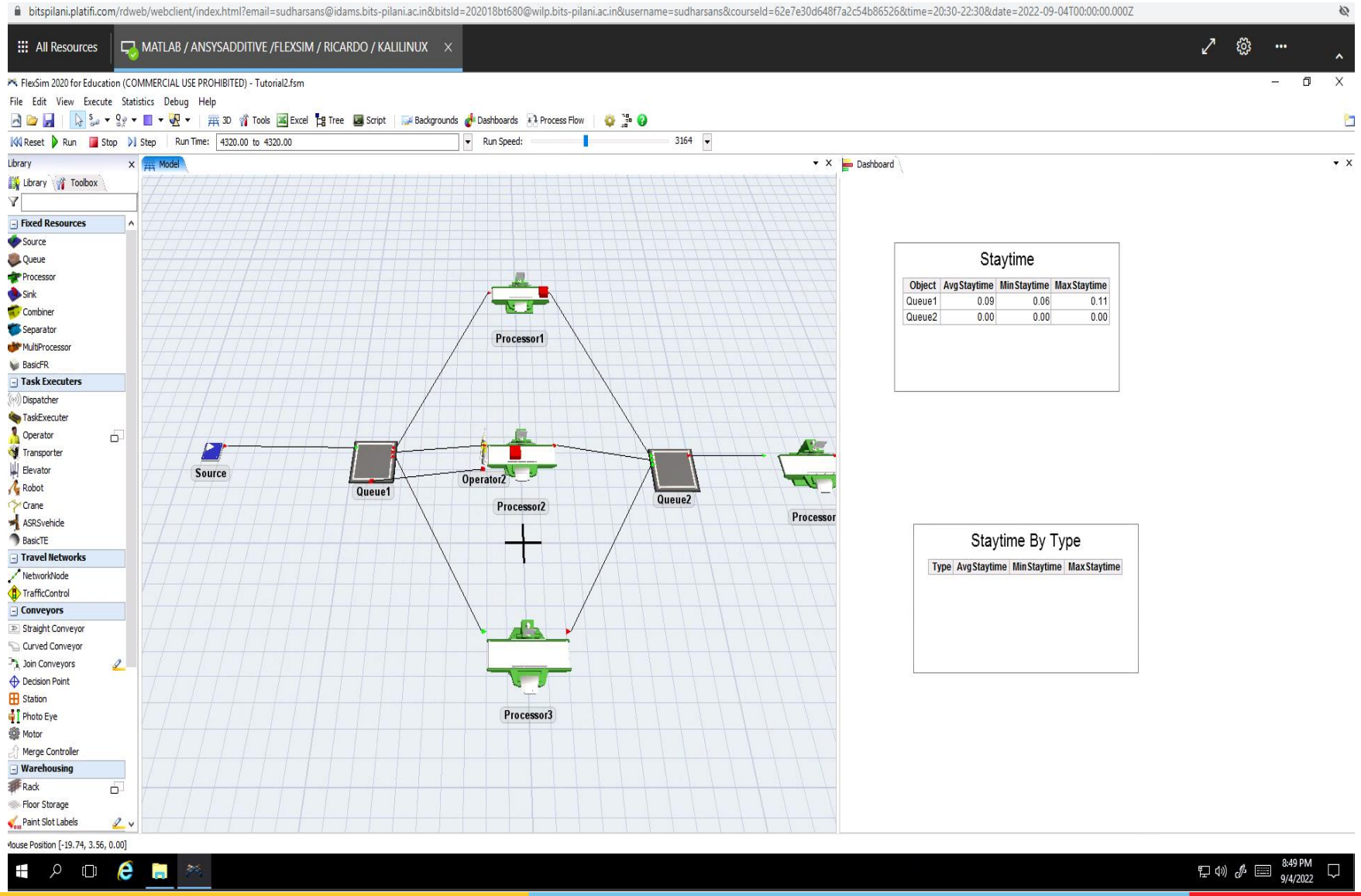
Model view: Tutorial 2 Throughput Estimation

Model Page



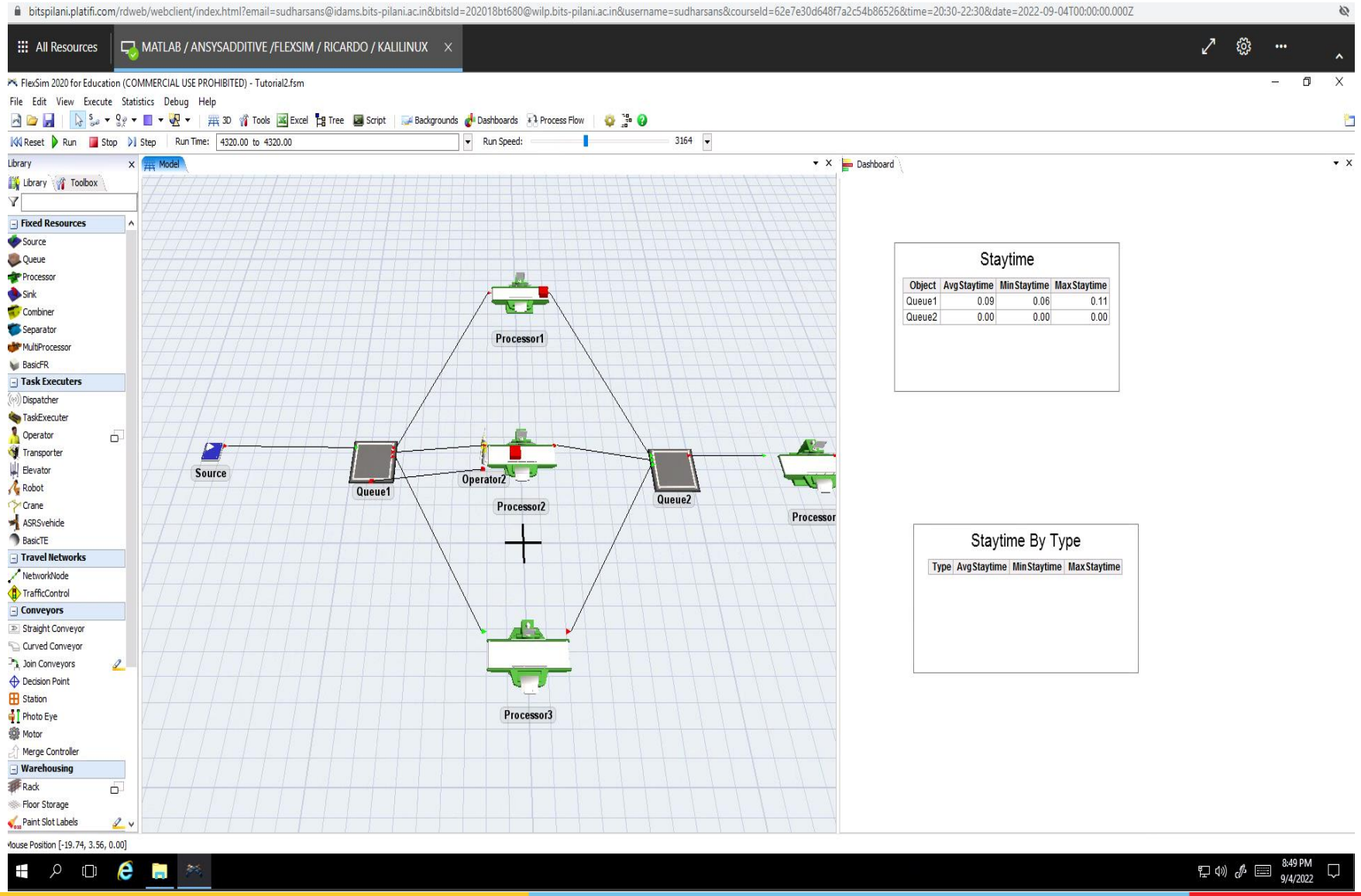
Model view: Tutorial 2 Throughput Estimation

2.1 Report the average waiting time at the raw material inventory



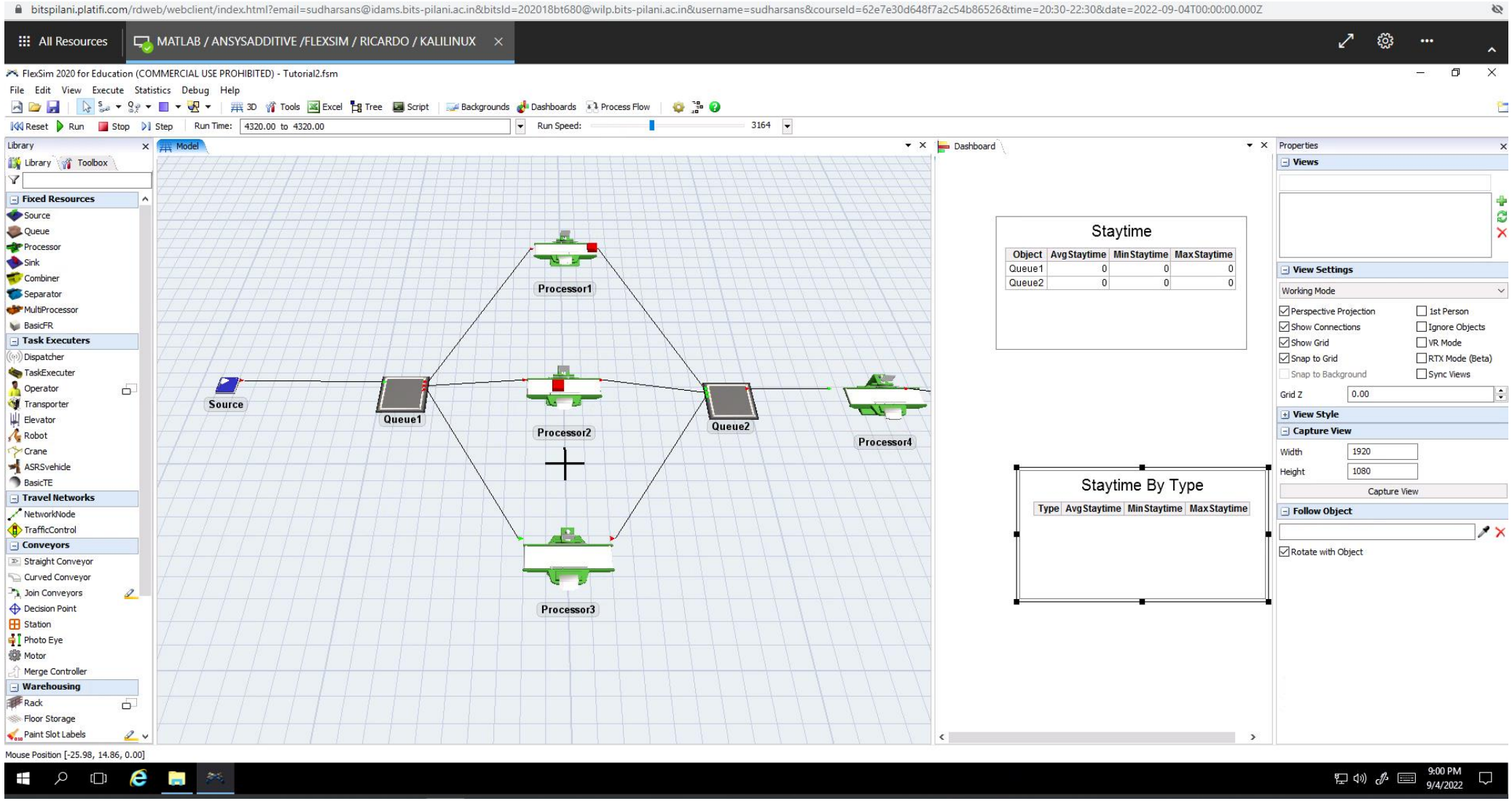
Model view: Tutorial 2 Throughput Estimation

2.2.1 Adding operator for all three processor



Model view: Tutorial 2 Throughput Estimation

2.2.2 No transport for all the processor



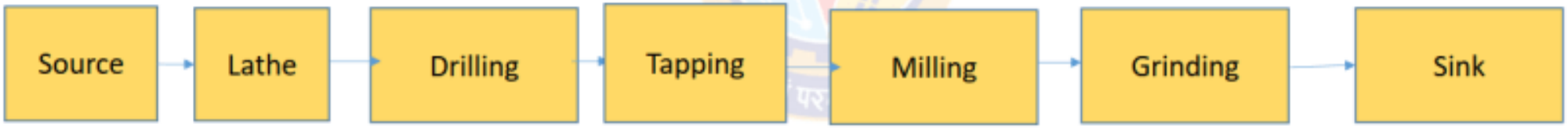
Comparison remarks

- 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.

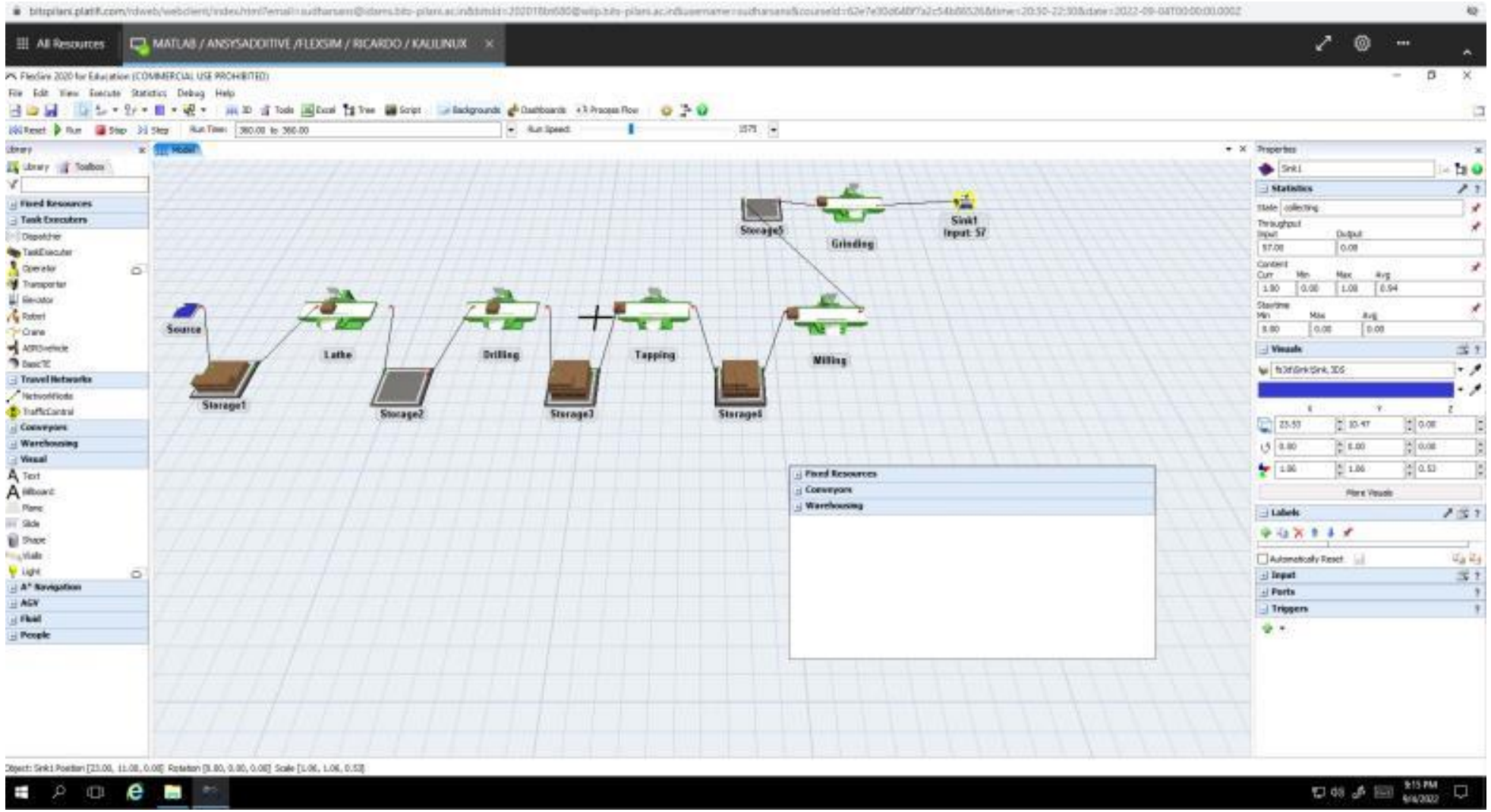
Model view: Tutorial 3 Resource capacity validation

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.

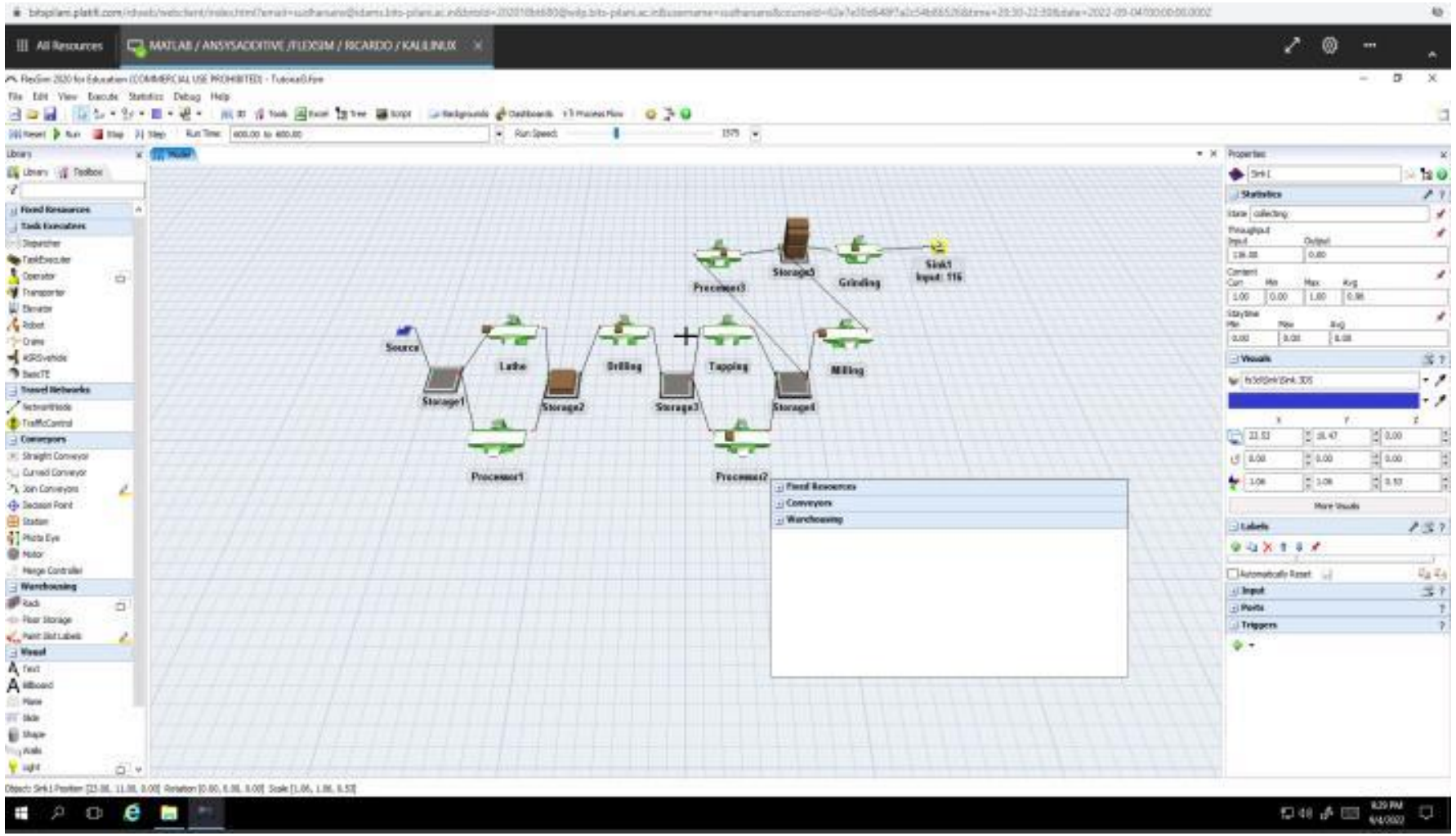


Model view: Tutorial 3 Resource capacity validation



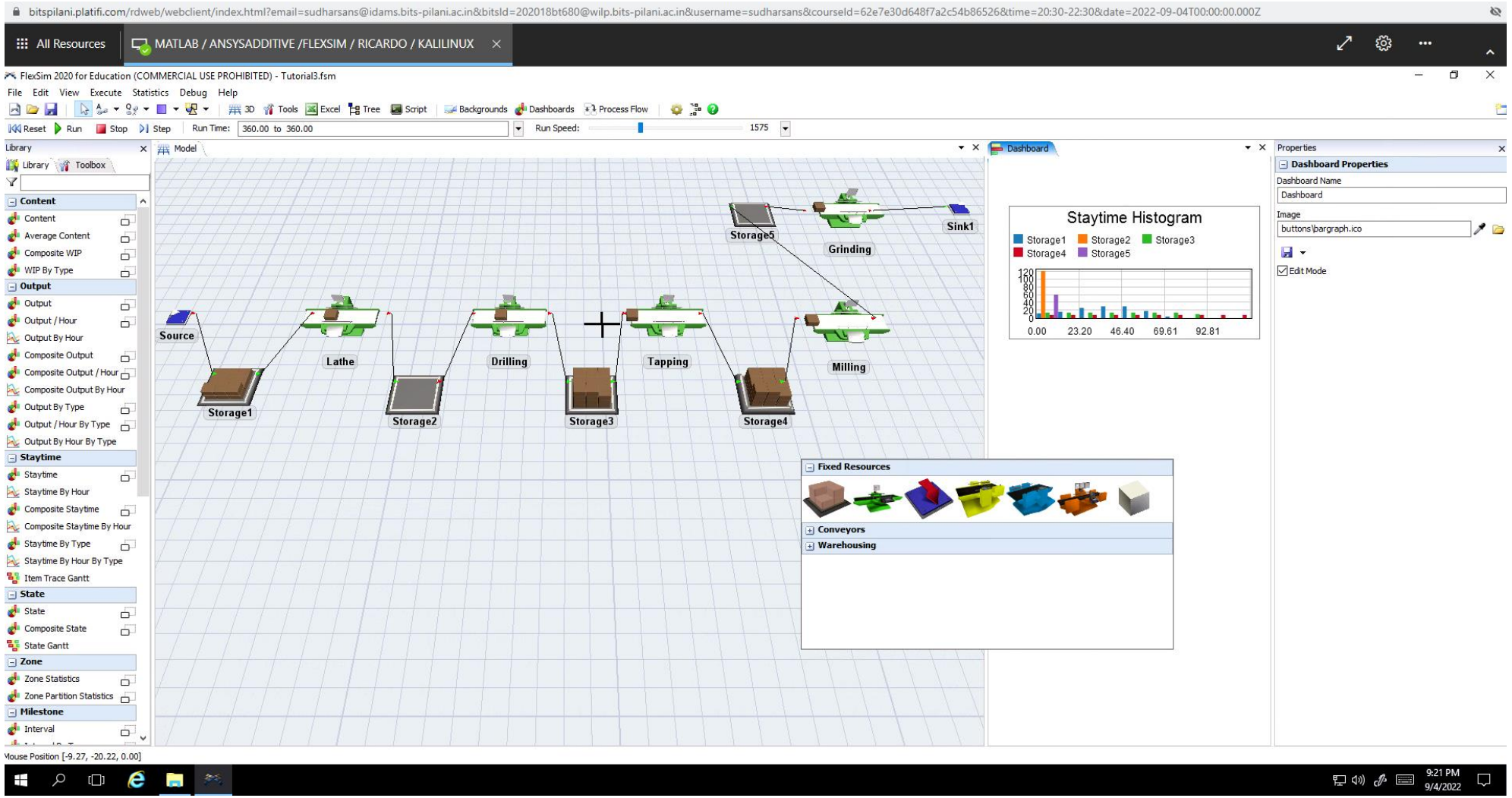
Model view: Tutorial 3 Resource capacity validation

3.1 output from machine shop in 6Hr shift)



Model view: Tutorial 3 Resource capacity validation

3.2 Stay time at each inventory station



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

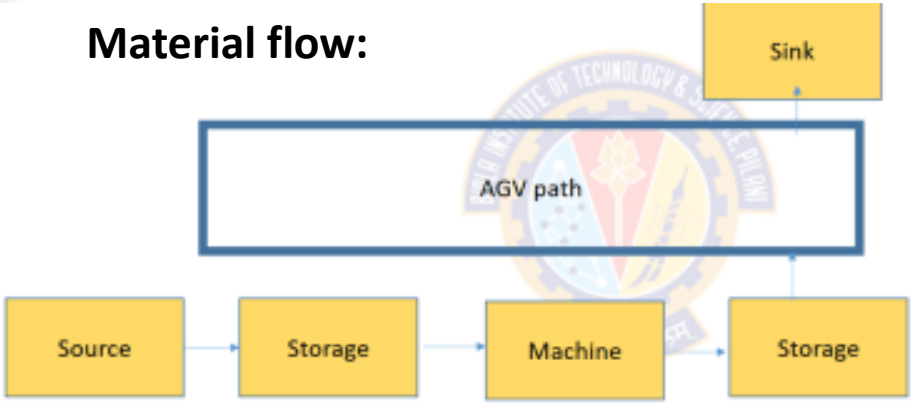
A plant uses AGV for handling a product across two production floor. Use the following resources and run the simulation model for one day. Company works in double shift, each shift runs for 8 hours. The shop floor manager wants to find out the inventory accumulation at the end of each day.

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,

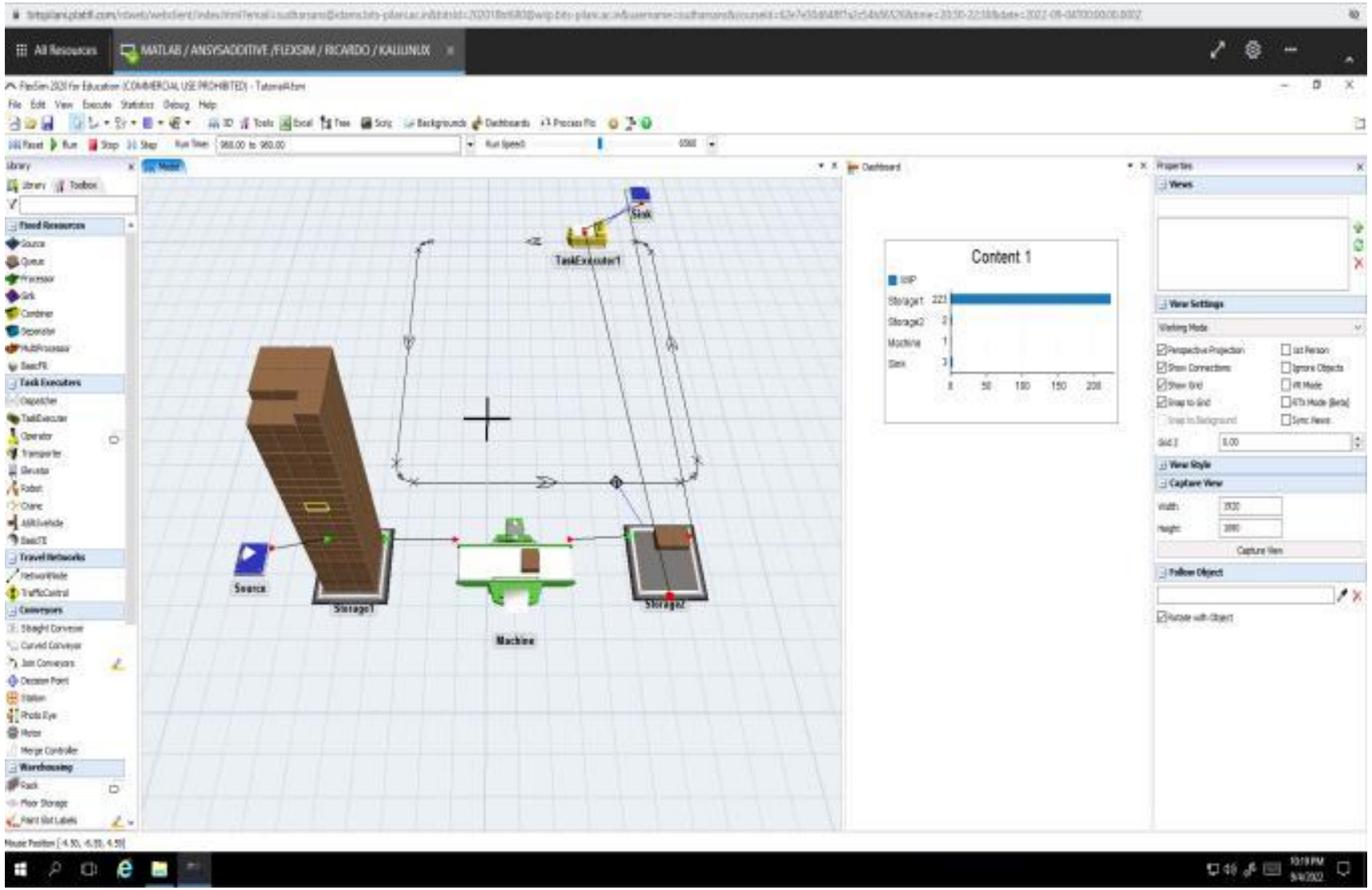
1. WIP
2. Stay time at storage
3. Total parts arrived and dispatched

Material flow:



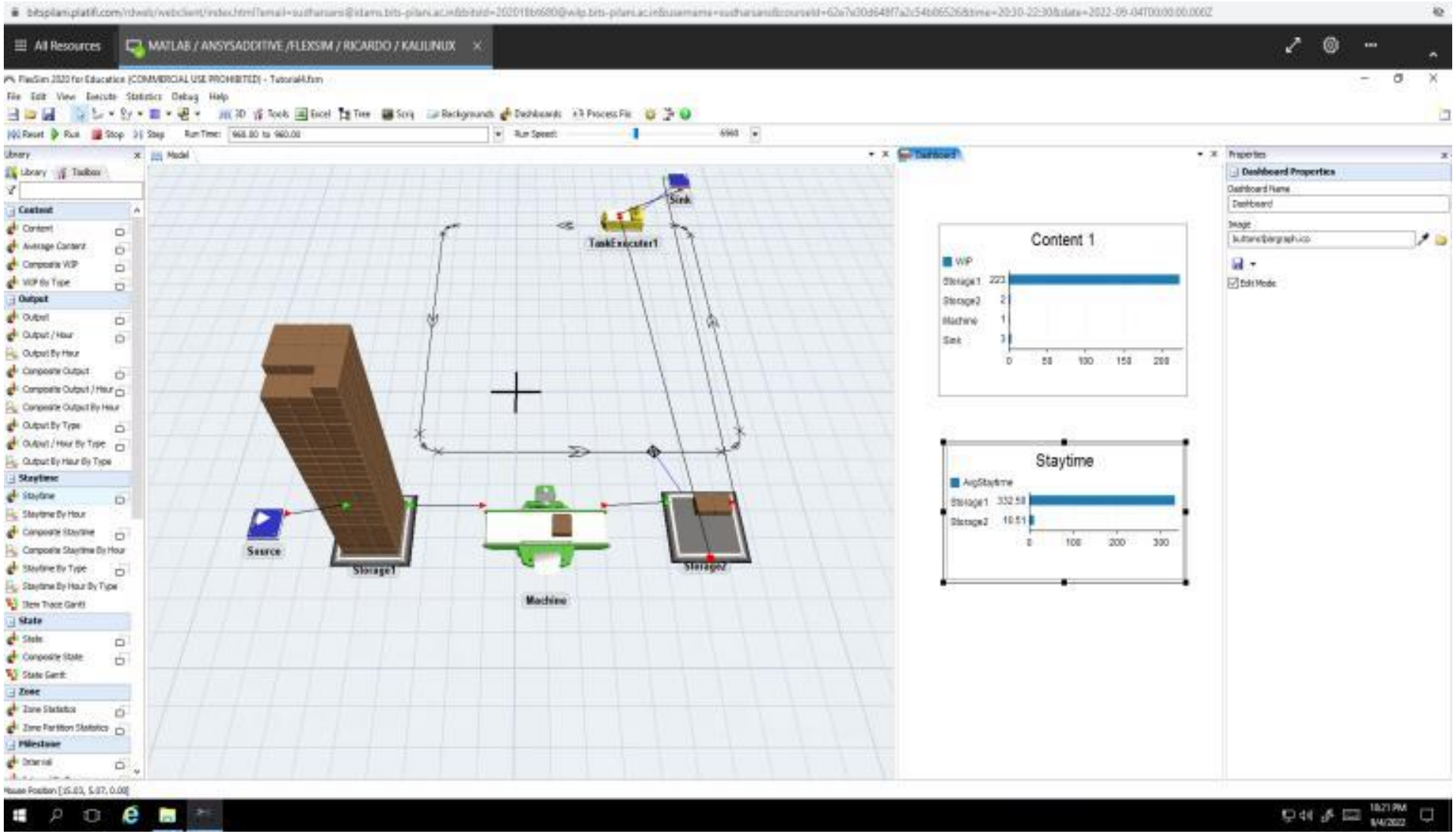
Model view: Tutorial 4 Daily Inventory analysis

4.1 Work In Progress



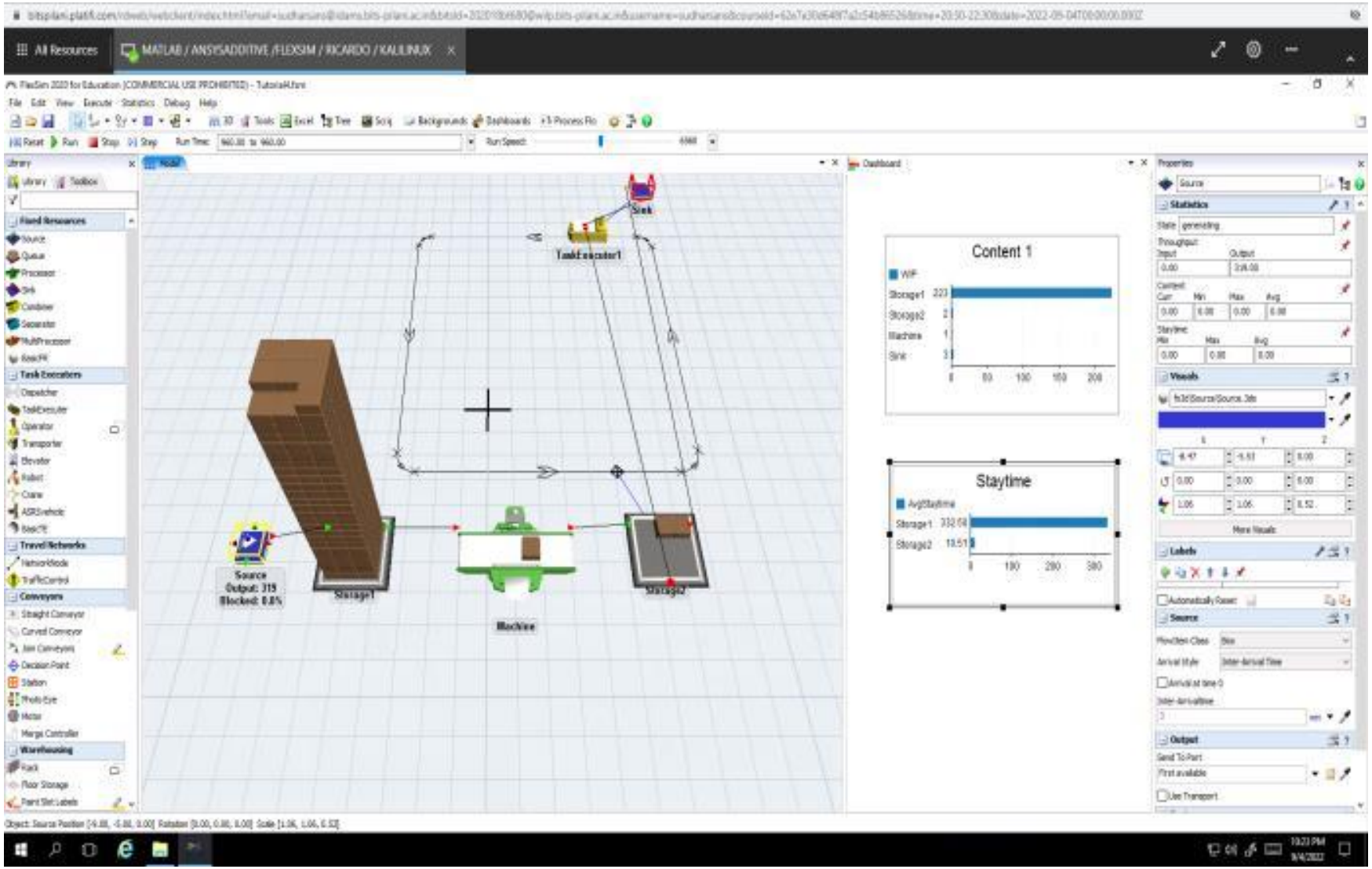
Model view: Tutorial 4 Daily Inventory analysis

4.2 Staytime at storage



Model view: Tutorial 4 Daily Inventory analysis

4.3 Parts Arrived



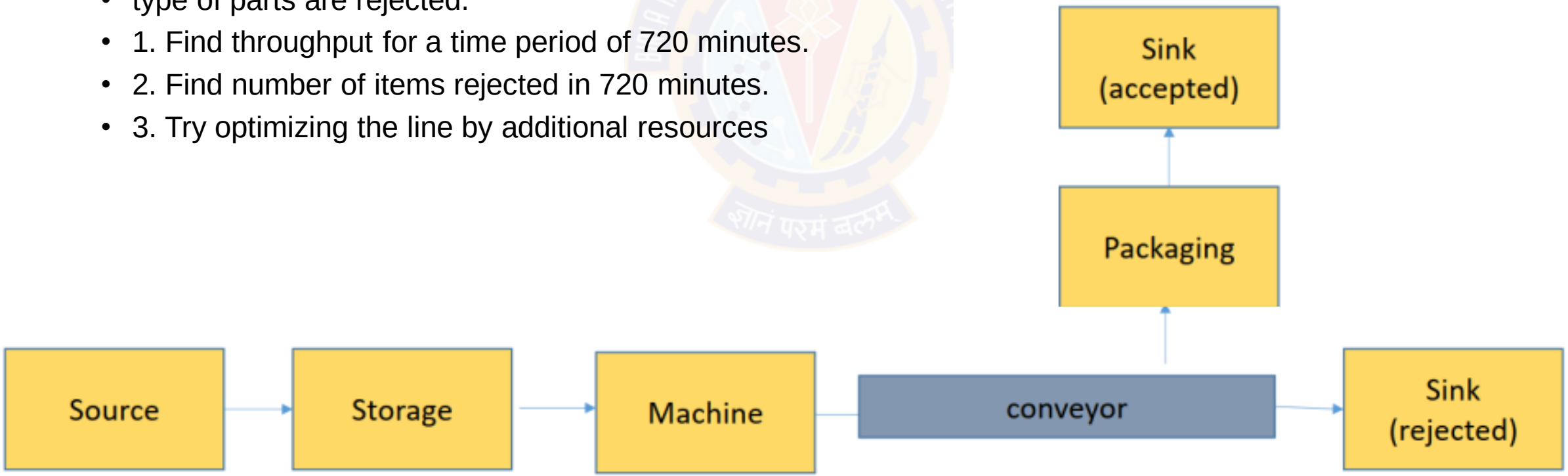
Comparison Remarks

- 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

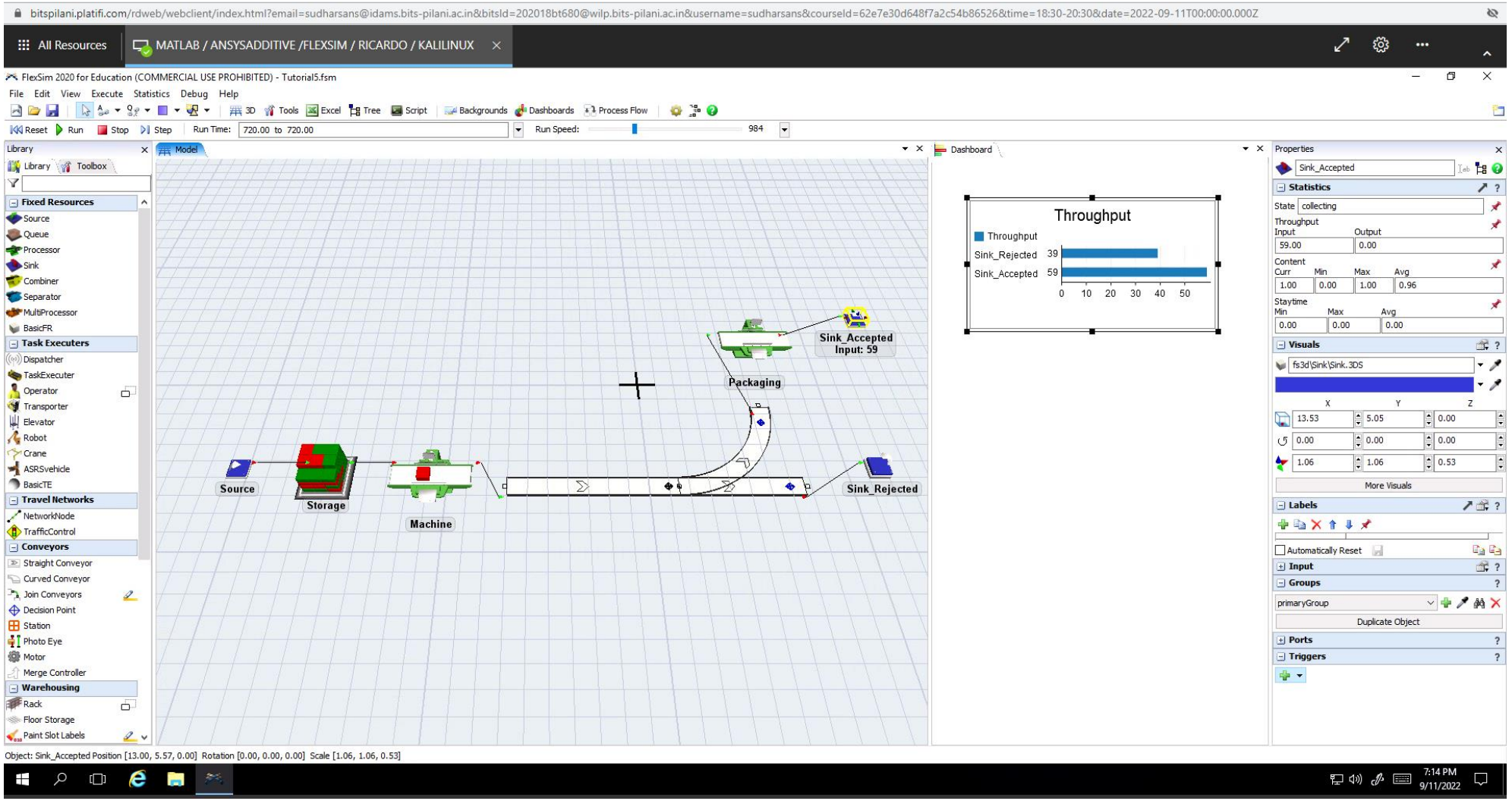
A conveyor systems supplier company proposed a design of a conveyor system. The buying company wants to see its simulation before purchasing it. Parts arrive in the quality testing shop floor following an exponential distribution (0,5,0) minutes. They want to the see the overall throughput of the proposed conveyor design for a time period of 720 minutes. There are mainly two kind of parts to be shorted 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



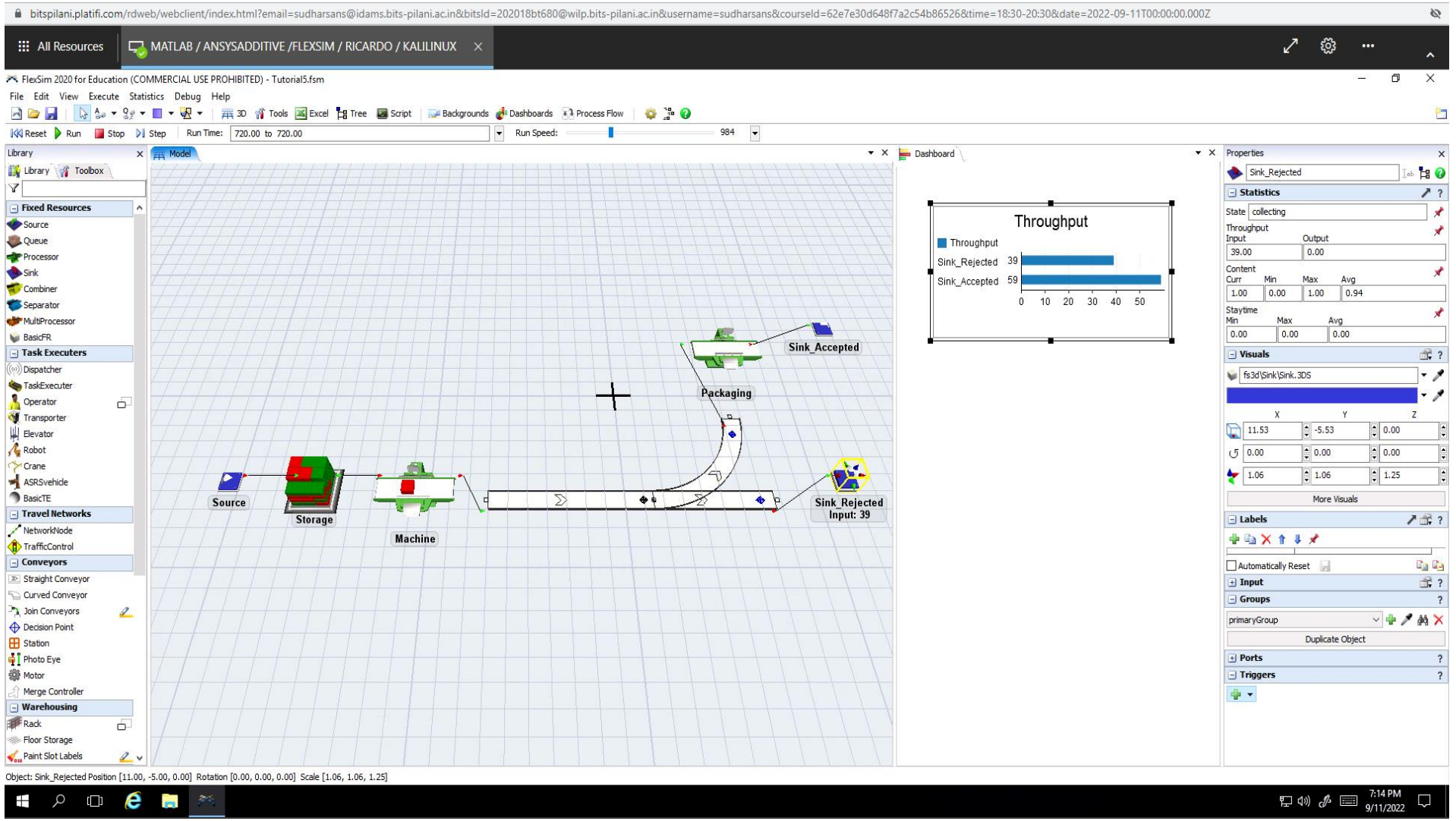
Model view: Tutorial 5 Equipment Performance Validation

5.1 Throughput and Number of items Rejected



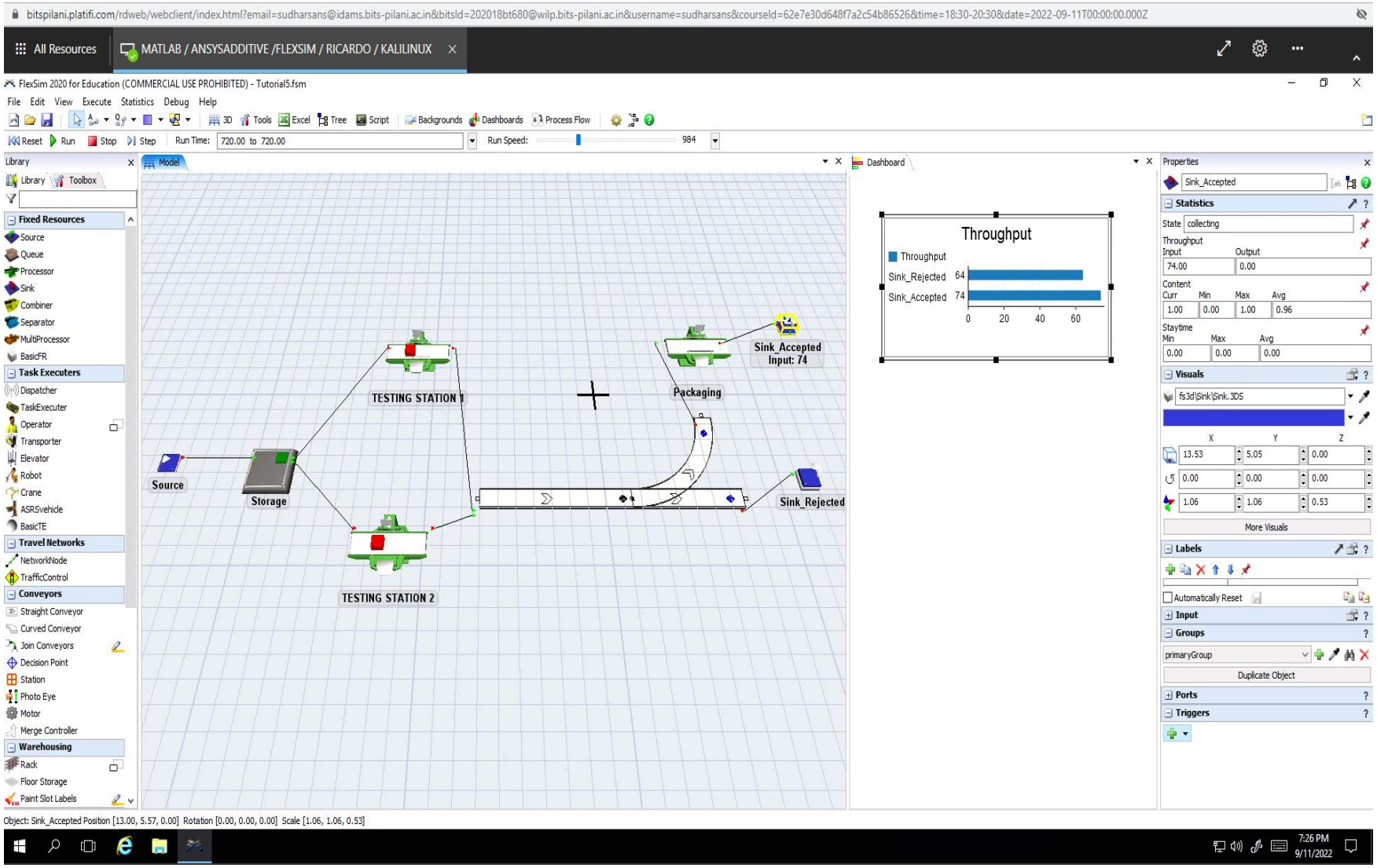
Model view: Tutorial 5 Equipment Performance Validation

5.2 Optimize the line by adding one more testing Machine



Model view: Tutorial 5 Equipment Performance Validation

5.3 Optimized Throughput at Sink_Accepted



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,

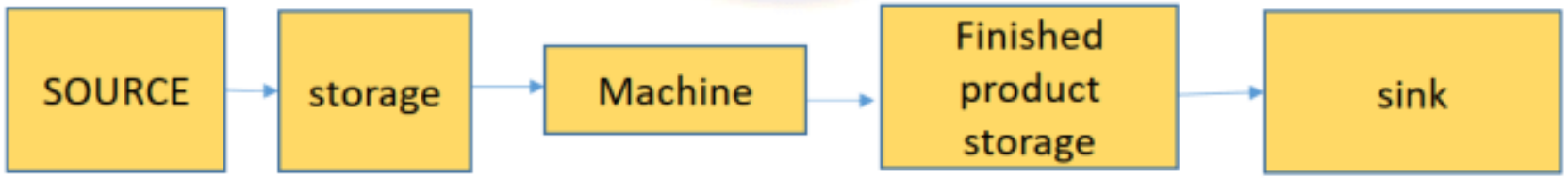
Arrival rate of shipment is exponential distribution of (0,5,0) min

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.

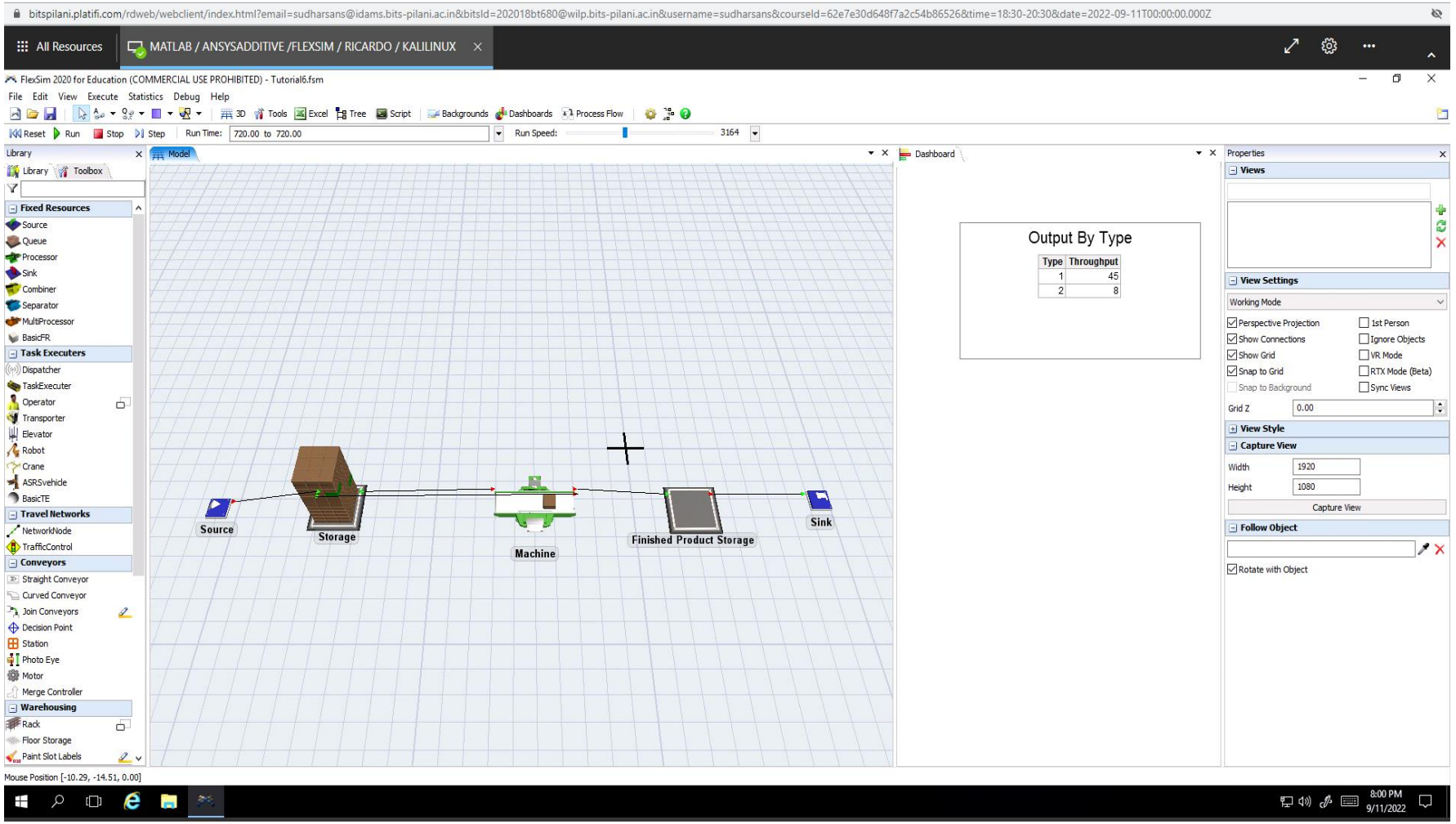
There are 20%chances that the parts will be reworked after processing and be sent back to the queue.

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



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.

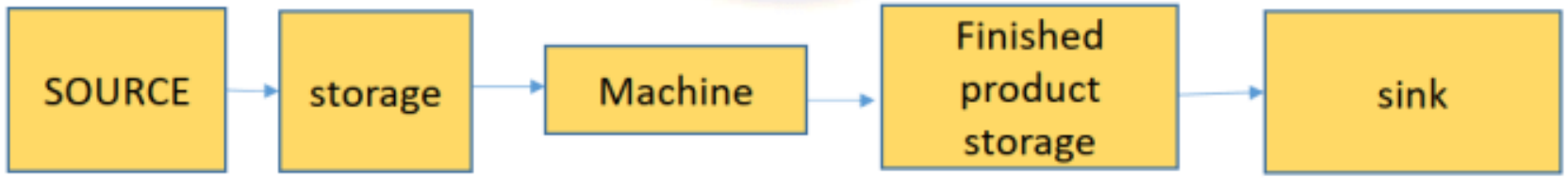
Use following specifications:

Conveyor speed, 10 m/min

Operator speed, 5 m/min

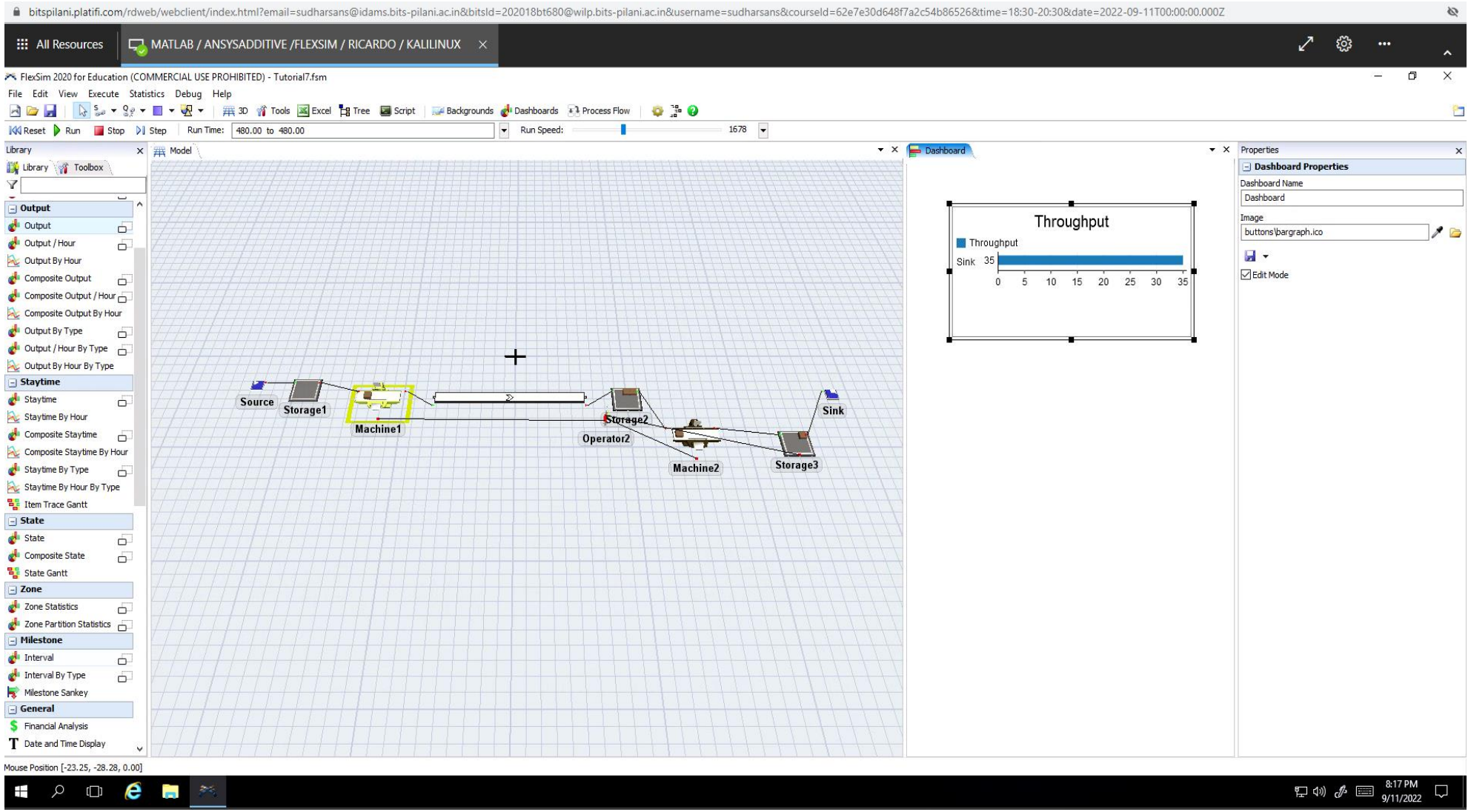
Processing time, 5 min

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



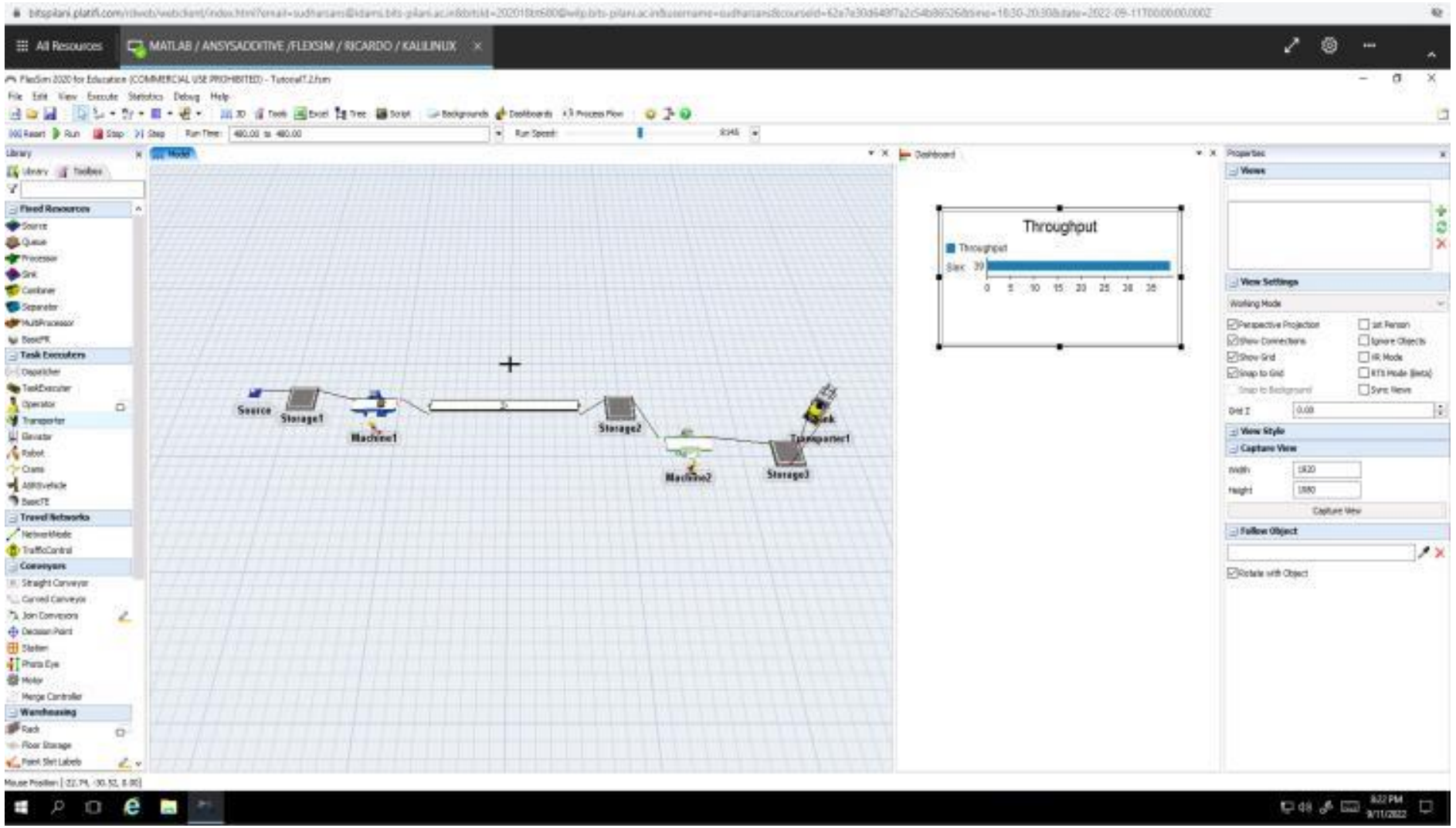
Model view: Tutorial 7

7.1 To find throughput in 480 mins of Run Model



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.

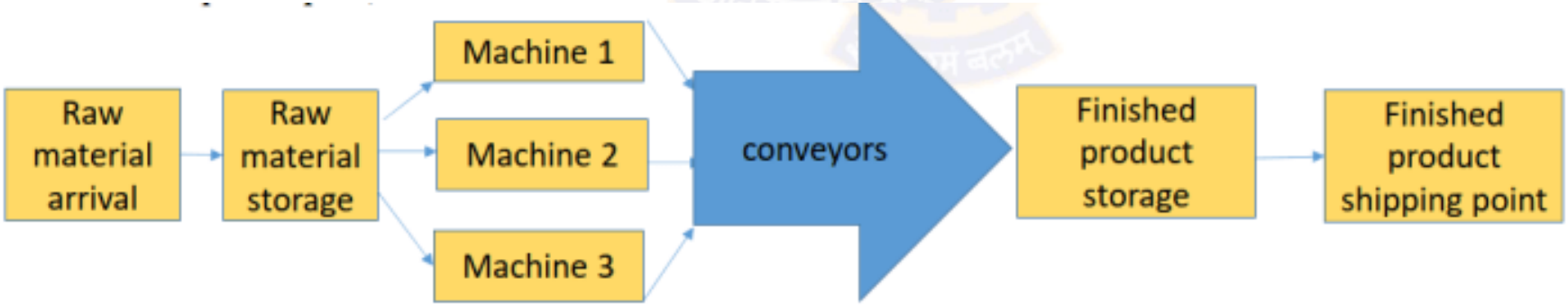
1. Arrange the resources on the shop floor and calculate throughput for a trial period of 12 hrs.
2. Compare the output if only 2 machines are operational.

Use following specifications:

Conveyor speed, 10 m/min

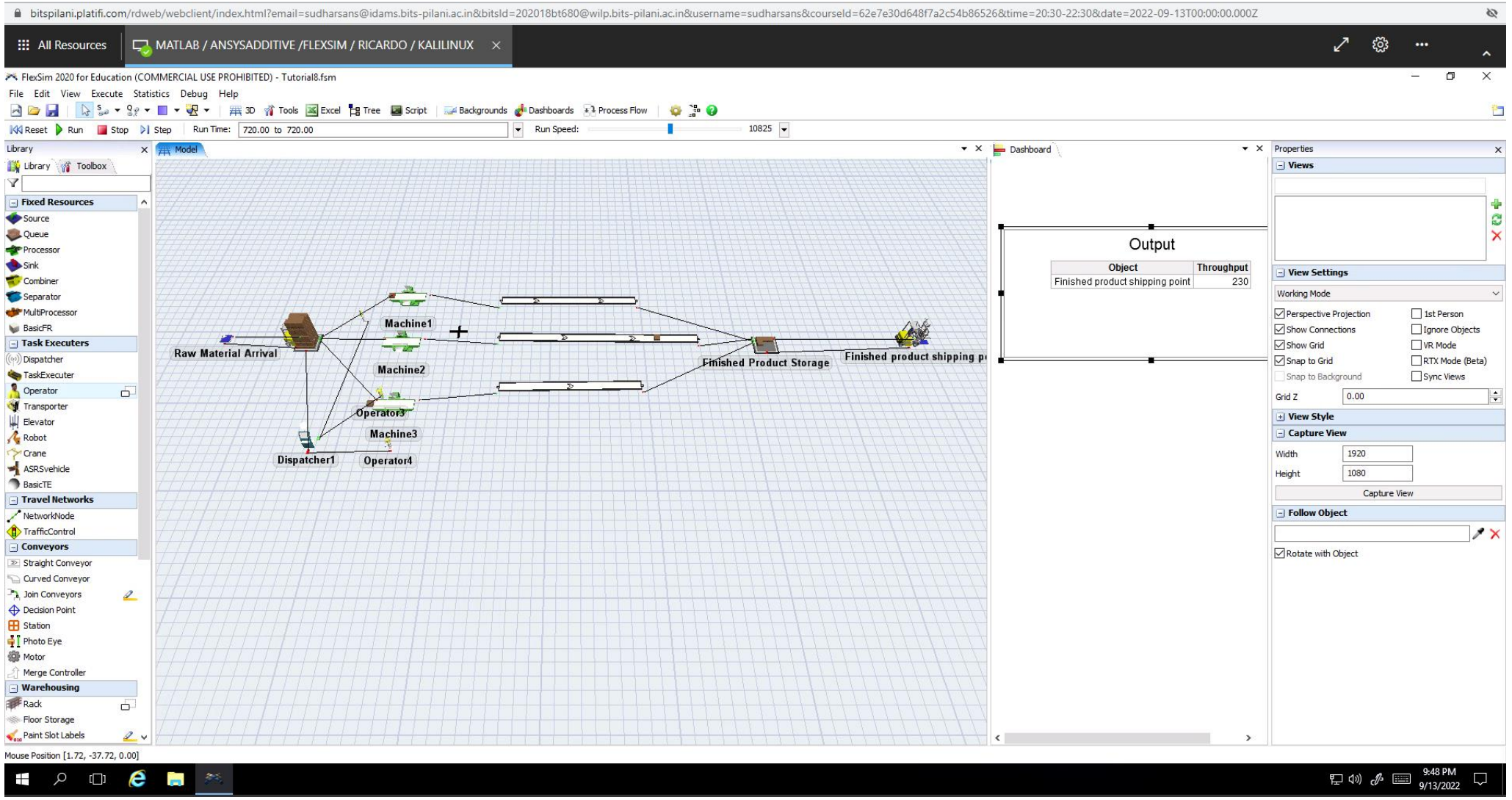
Operator speed, 5 m/min

transporter speed, 60 m/min



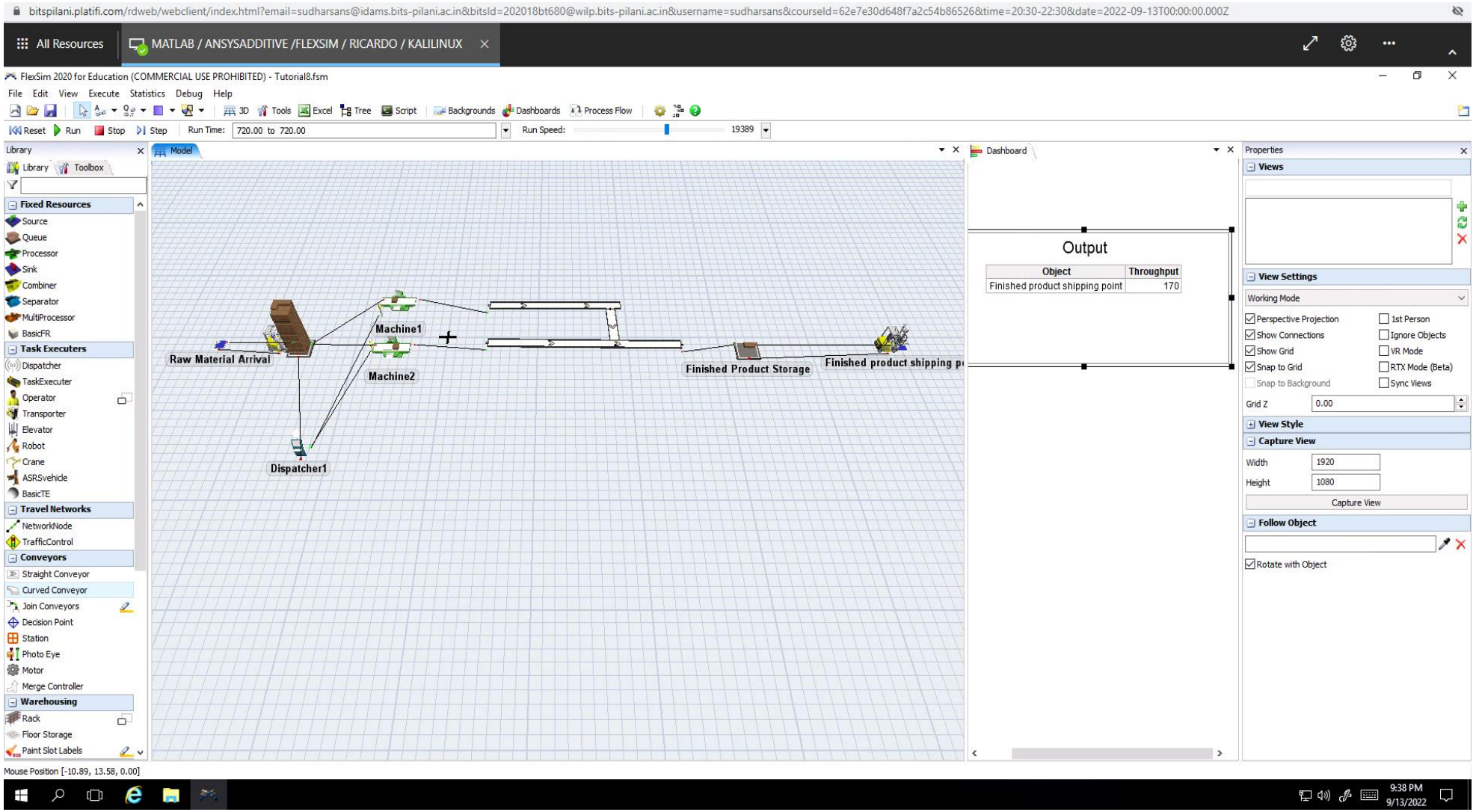
Model view: Tutorial 8 SHOP FLOOR MANAGEMENT

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



Model view: Tutorial 8 SHOP FLOOR MANAGEMENT

8.2 Only two machines are operational



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