Simulation
Exam – Final Spring 2017 Printed Name_____ ID _____

Problem 5: (10 points)

A small manufacturing system produces parts. The parts arrive from an upstream Poisson process with a rate of arrival of 1 part every 5 minutes. All parts that enter the system must go through a preparation station where there are 2 preparation workers. Each part requires only 1 of the 2 workers during preparation. The preparation time is exponentially distributed with means of 8 minutes.

There is only space for 8 parts in the preparation queue. Any parts that arrive to the system when there are 8 or more pars in the preparation queue cannot enter the system. These parts are shunted to a re-circulating conveyor, which takes 12 minutes to re-circulate the parts before they can try again to enter the preparation queue.

After preparation, the parts are processed on two different production lines. There is a 40% chance that the parts are built on line 1 and a 60% chance that they go to line 2. Line 1 has a build station staffed by 2 workers. Line 2 has a build station that is staffed by 3 workers. The time to build a part on line 1 is triangularly distributed with a (min = 2, mode 6, max = 8) minutes. The time to build a part on line 1 is triangularly distributed with a (min = 3, mode 6, max = 7) minutes. The build time requires only 1 worker for the task to be performed.

After the parts are built they go to a packaging station. The packaging station is staffed by 2 workers. Only 1 of the 2 workers is needed by each part. The time to individually wrap a part is exponential with a mean of 30 seconds. After each individual part is wrapped, the worker fills a box with packing peanuts, and places the part into a box for shipping. The time to fill the box with peanuts is uniformly distributed between 1 and 2 minutes. After the packaging, the box leaves the system.

a. What are the necessary entities and resources for this problem
b. Draw an activity flow diagram for this situation.

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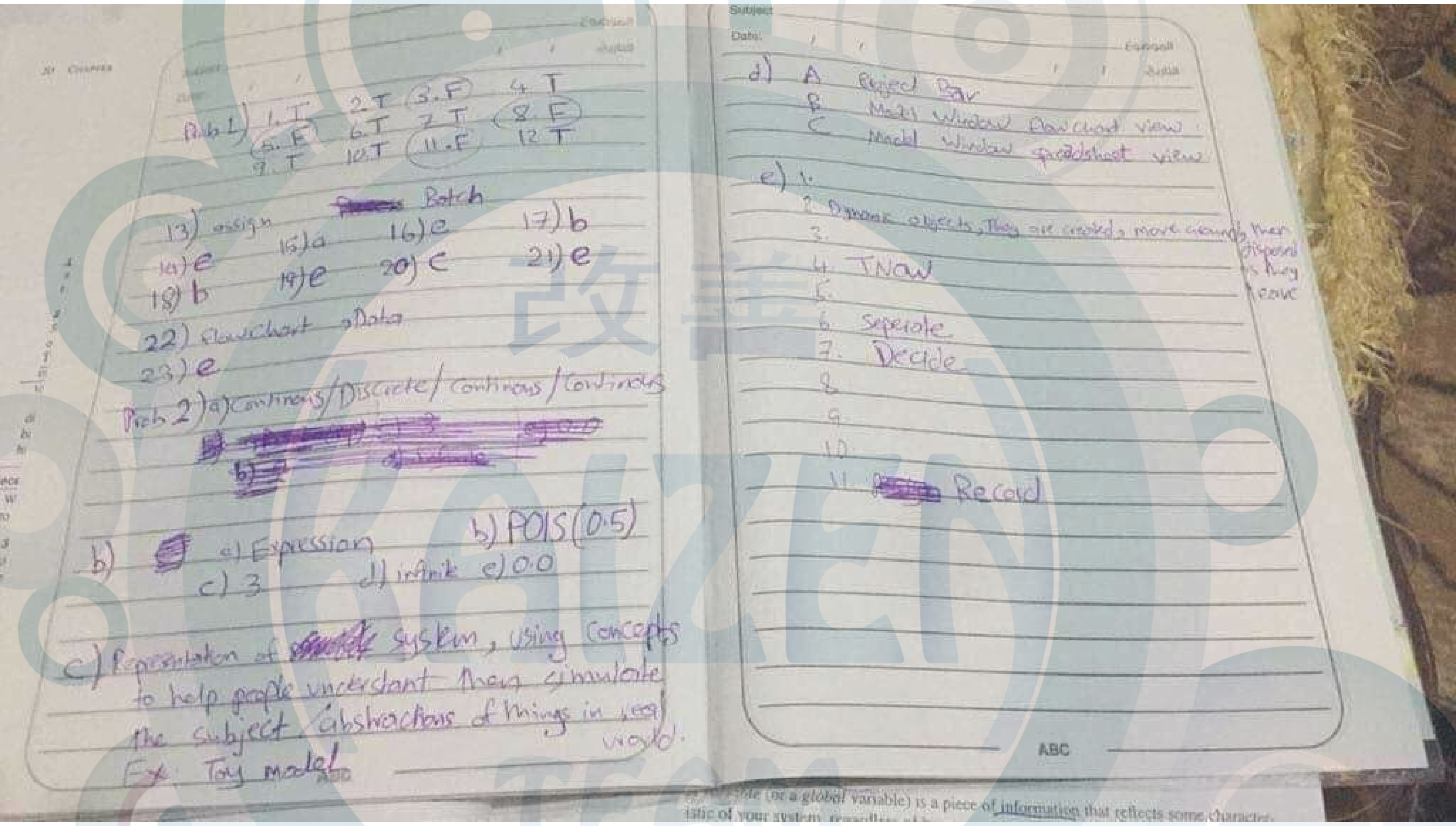
e. Fill in the proper Arena construct name for the given functionality

Arena Construct	Description Functionality
	Something that can potentially constrain the flow of an entity within the system
Entity	
	Quantities that are properties of entities with a specific value
	A special pre-defined variable that Arena uses to represent the current simulation time
	Quantities that are properties of the system (as a whole) that change or are determined by the relationships between the components of the system as it evolves through time.
	This module is used to create duplicates of an existing entity or to split a batched group of entities.
	This module is used to provide alternative flow paths for an entity based on probabilistic or criteria based branching
	A function that returns the number of entities waiting in a queue
	This module can be used to represent a time-varying arrival pattern for a CREATE module
	This module is used for specifying new values to variables, entity attributes, entity types, entity pictures, or other system variables.
	Used to capture and tabulate statistics within the flow chart model area



Prob 1) 1. T 2. T 3. F 4. T
5. F 6. T 7. T 8. F
9. T 10. T 11. F 12. T

13) assign ~~[illegible]~~ Batch
14) e 15) a 16) e 17) b
18) b 19) e 20) c 21) e
22) Flowchart , Data
23) e

Prob 2) a) Continuous / Discrete / Continuous / Continuous

b) ~~[illegible]~~ a) Expression b) POIS(0.5)
c) 3 d) infinite e) 0.0

c) Representation of ~~[illegible]~~ system, using concepts to help people understand them simulate the subject. abstractions of things in real world.
Ex. Toy model

d) A Project Bar
B Model Window flowchart view
C Model Window spreadsheet view

e) 1.
2. Dynamic objects, They are created, move around, then disposed as they leave
3.
4. TNow
5.
6. seperate
7. Decide
8.
9.
10.
11. ~~[illegible]~~ Record

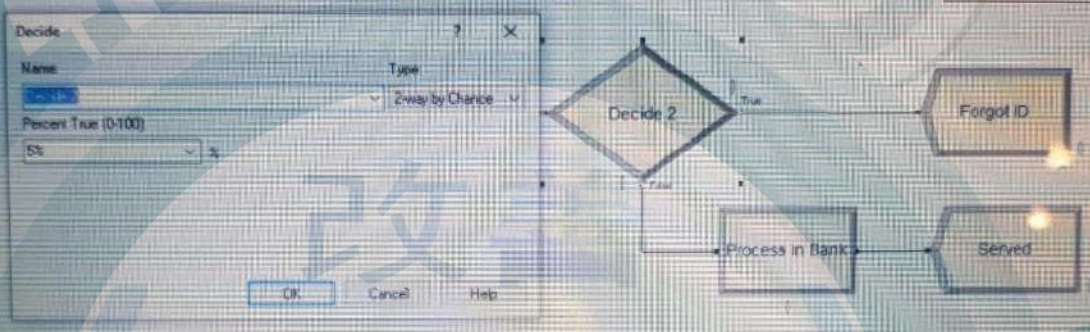
Not yet answered

Marked out of 1.00

Flag question

If this part of the Bank model has an error, what is it?

Time left 0:22:57



- a. Dispose modules should be swapped
- b. The percentage should be 95%
- c. Has no error
- d. The Type should be 2-way by condition

Clear my choice

Finish

Final Fall 2020

Time left 0:25:55

Question 13

Not yet answered

Marked out of 1.00

Flag question

Global Expression stores formulas as well as numbers, it can be scalar, or vector, or matrix

Select one:

- True
- False

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Time left 0:37:57

Question 7

Not yet answered

Marked out of 1.00

Flag question

A _____ does not store formulas, it just stores numbers and it can be one of the following types: scalar, or vector, or matrix.

a. Attribute

b. Schedule

c. Variable

d. Expression

Next page

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Time left 0:33:01

Question 9

Not yet answered

Marked out of 1.00

Flag question

One of the following is not an event:

a. Third entity leaves the service

b. Arrival of the second entity

c. Entity leaving the queue and starts service

d. When the simulation clock hits the final simulation time

Time left 0:34:4

Question 8

Not yet answered

Marked out of 1.00

Flag question

User-defined values associated with individual entities, such as customer type, product size, time job entered the system etc. are examples of

a. None of the above

b. Fake-Entities

c. Variables

d. System Events

e. Attributes

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Time left 0:47:02

Question 3

Not yet answered

Marked out of 1.00

Flag question

Incorrectly specifying the delay logic in the process module from "Seize Delay Release to Seize Delay" is an issue that should be fixed using

a. Type II error

b. Verification

c. Validation

d. Steady state system

Next page

Time left 0:52:35

Question 2

Not yet answered

Marked out of 1.00

Flag question

A set of approximations and assumptions, both structural and quantitative, about the way the system does or will work. This is the definition of:

- a. Steady State of the System
- b. Validation
- c. Simulation system
- d. Logical Model

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Quiz navigation

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Time left 0:54:50

Question 1

Not yet answered

Marked out of 1.00

Flag question

A failure policy must be attached to two resources or more.

Select one:

- True
- False

Time left 0:42:04

Question 4

Not yet answered

Marked out of 1.00

Flag question

Not releasing a resource before leaving the model is an issue (select all that apply)

- a. Syntax error due to entity trying to take the resource out of the system
- b. The output from the model will be one
- c. It should be realized by verification not validation
- d. The output from the model will be zero

Next page

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Time left 0:12:05

Question 20

Not yet answered

Marked out of 1.00

Flag question

We may have more than one entity type and multiple realizations of the entities in the same system

Select one:

- True
- False

Next page

Time left 0:31:31

Question 10

Not yet answered

Marked out of 1.00

Flag question

One of the problems in the Queueing theory analysis approach in queuing systems is the time frame, which is due to the assumption

a. Service times ~ exponential, independent of inter-arrivals

b. Steady-state

c. Must have E(service) < E(inter-arrival)

d. Inter-arrival times ~ exponential

Time left 0:14:01

Question 19

Not yet answered

Marked out of 1.00

Flag question

Over simplifying a model by making assumptions will allow us to use traditional methods easily

Select one:

- True
- False

Time left 0:00:26

Question 26

Not yet answered

Marked out of 1.00

Flag question

One of the following is a valid termination condition for the Bank problem (time in minutes).

a. TNOW >= 0 && TotalWP == 0

b. TNOW >= 420 && TotalWP == 0

c. TNOW >= 420 || TotalWP == 0 (|| means Or)

d. TNOW == 420 && TotalWP == 0

Time left 0:38:54

Question 6

Not yet answered

Marked out of 1.00

Flag question

In the simulation, when doing more than one replication, the system will be valid

Select one:

- True
- False

Next page

Time left 0:40:28

Question 5

Not yet answered

Marked out of 1.00

Flag question

Comparing results from the simulation with actual data from the real system is helpful to

a. Validate the model

b. avoid type II error

c. Verify the model

d. Improve on animation

Next page

Question 17

Not yet answered

Marked out of 1.00

Flag question

Time left 0:16:46

The news vendor problem is an example of

a. Dynamic, Continuous, Deterministic

b. Static, Discrete, Stochastic

c. Dynamic, Discrete, Stochastic

d. Dynamic, Continuous, Stochastic

Time left 0:23:02

Question 15

Not yet answered

Marked out of 1.00

Flag question

If a model is simple enough, it is better to use

a. Cash-flow principles

b. Monte-Carlo Simulation

c. Simulation

d. Traditional mathematical approaches

Question 25

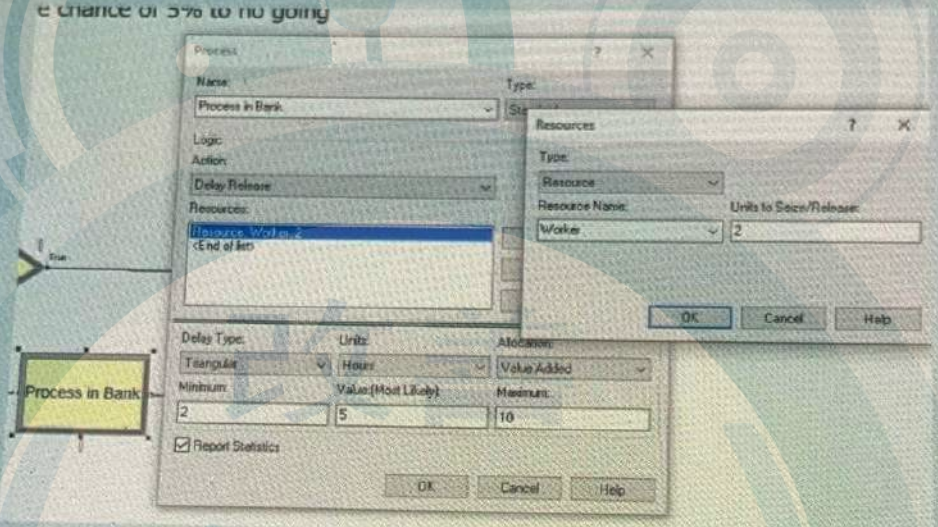
Not yet answered

Marked out of 1.00

Flag question

Time left 0:01:37

How many errors in the processing module are there (if any)?



a. Three

b. Two

c. Zero

d. One

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Time left 0:15:10

Question 18

Not yet answered

Marked out of 1.00

Flag question

If a system changes significantly with respect to time, it is said to be

a. Dynamic

b. Static

c. Deterministic

d. Stochastic

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Time left 0:28:46

Question 11

Not yet answered

Marked out of 1.00

Flag question

The Buffon needle problem to estimate the value of Π (pi), is an example of

a. Dynamic Simulation

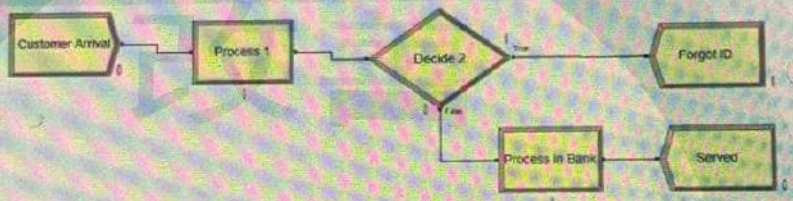
b. Model Verification

c. Mathematical approach

d. Monte-Carlo (static) simulation

be served and leave through another door. The Bank will not shut down until all customers are flushed out (given it is 3:00 pm or after). There is just one process in this system that needs one of the 2 workers available to work on it. Incoming customers have the chance of 5% to not going through the process since they forgot their I.D. The process takes TRIA(2,5,10) minutes.

The model needs necessary modeling to represent the:



- a. Shutdown at 3:00pm
- b. Processing customers after 2:00pm
- c. Counting number of leaving customers
- d. Closing incoming doors at 3:00pm

Next page

Time left 0:05:23

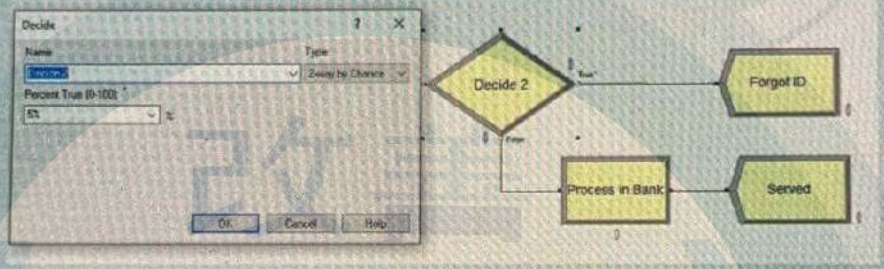
Question 24

Not yet answered

Marked out of 1.00

Flag question

If this part of the Bank model has an error, what is it?



a. Has no error

b. Dispose modules should be swapped

c. The Type should be 2-way by condition

d. The percentage should be 95%

Not yet answered

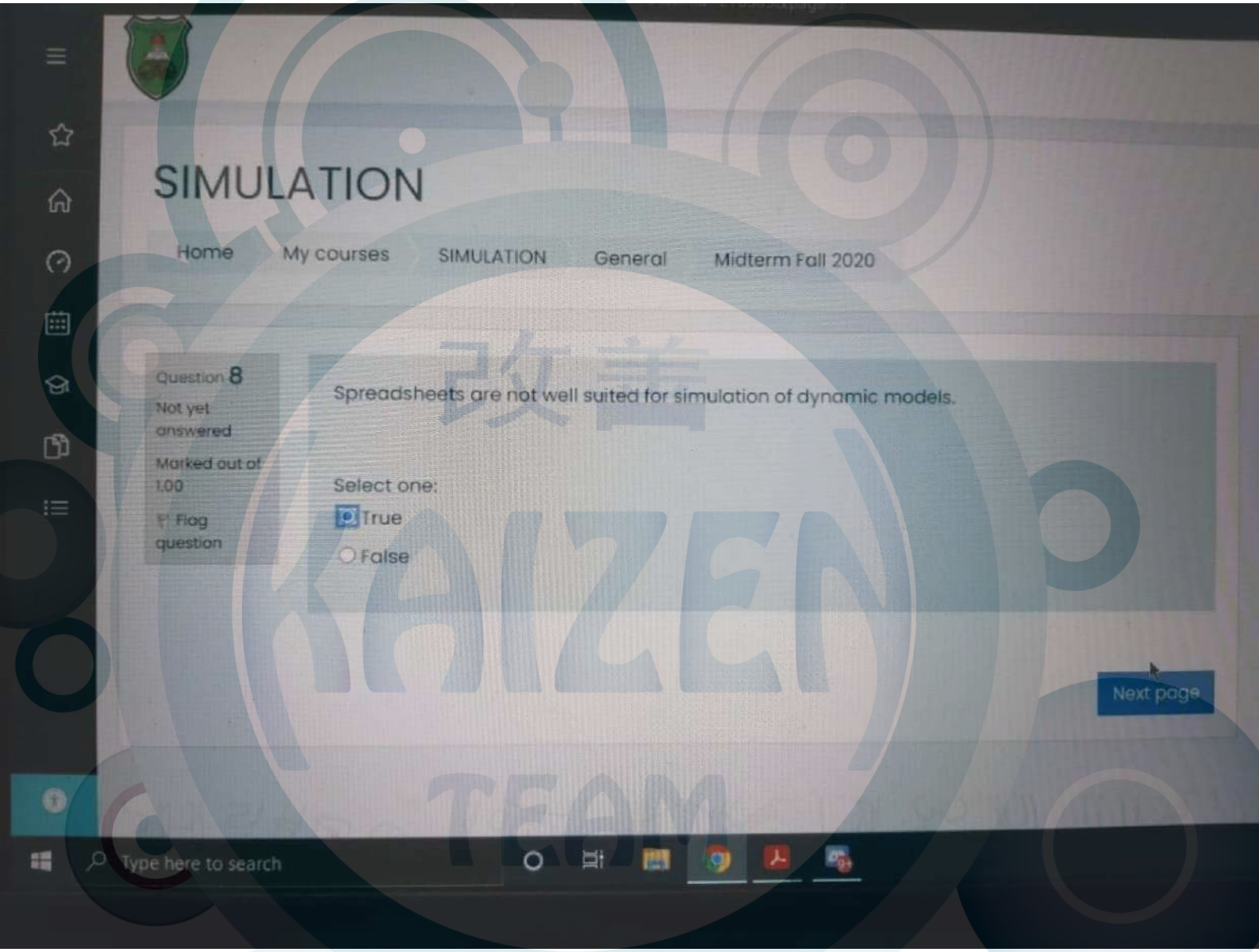
Marked out of 1.00

Flag question

Time left 0:43:48

Incorrectly specifying the delay logic in the process module from "Seize Delay Release to Seize Delay" is an issue that should be fixed using

- a. Type II error
- b. Verification
- c. Validation
- d. Steady state system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Question 8
Not yet answered
Marked out of 1.00
Flag question
Spreadsheets are not well suited for simulation of dynamic models.
Select one:
True
False
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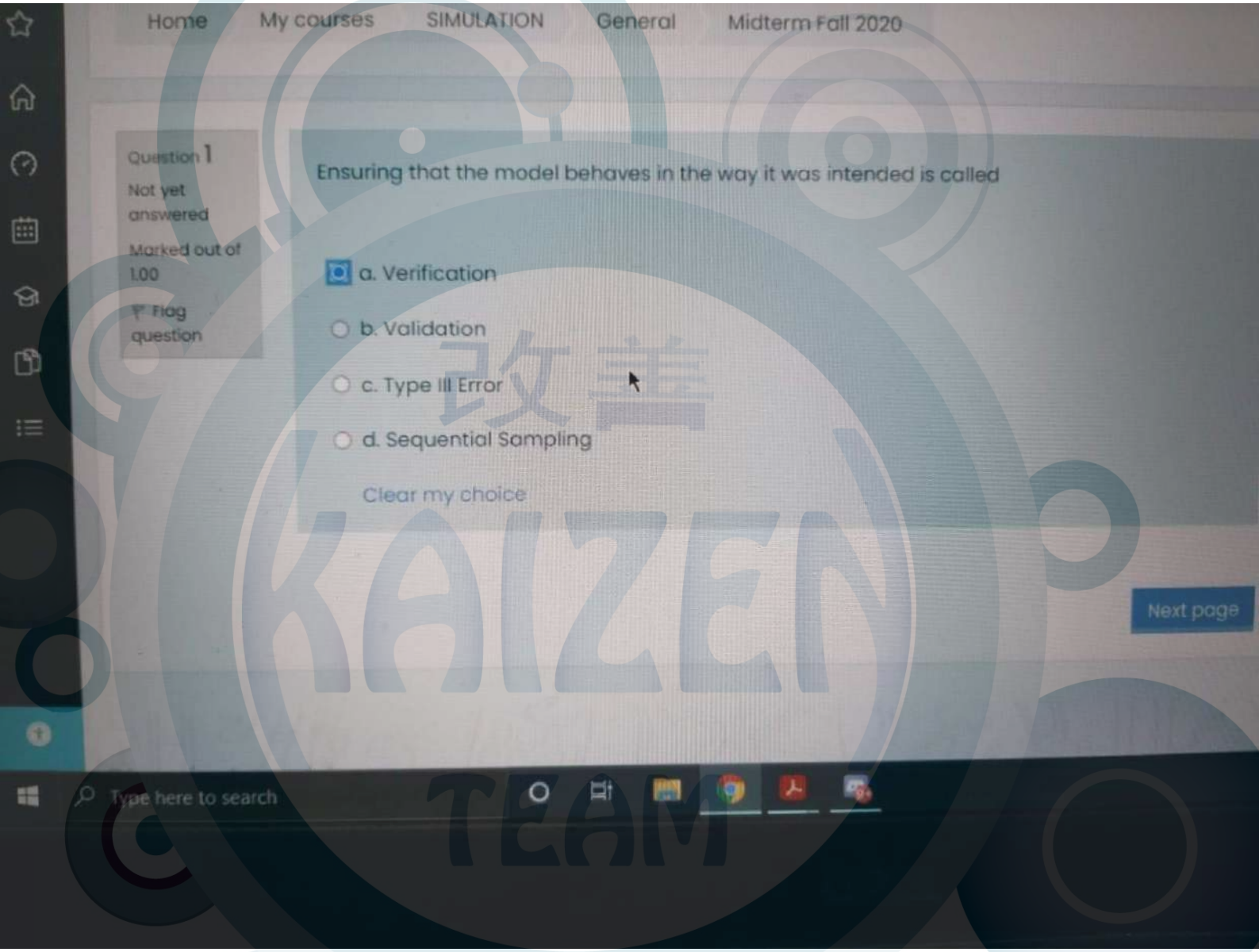
Type here to search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Not yet answered
Marked out of 1.00
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Ensuring that the model behaves in the way it was intended is called
a. Verification
b. Validation
c. Type III Error
d. Sequential Sampling
Clear my choice
Next page
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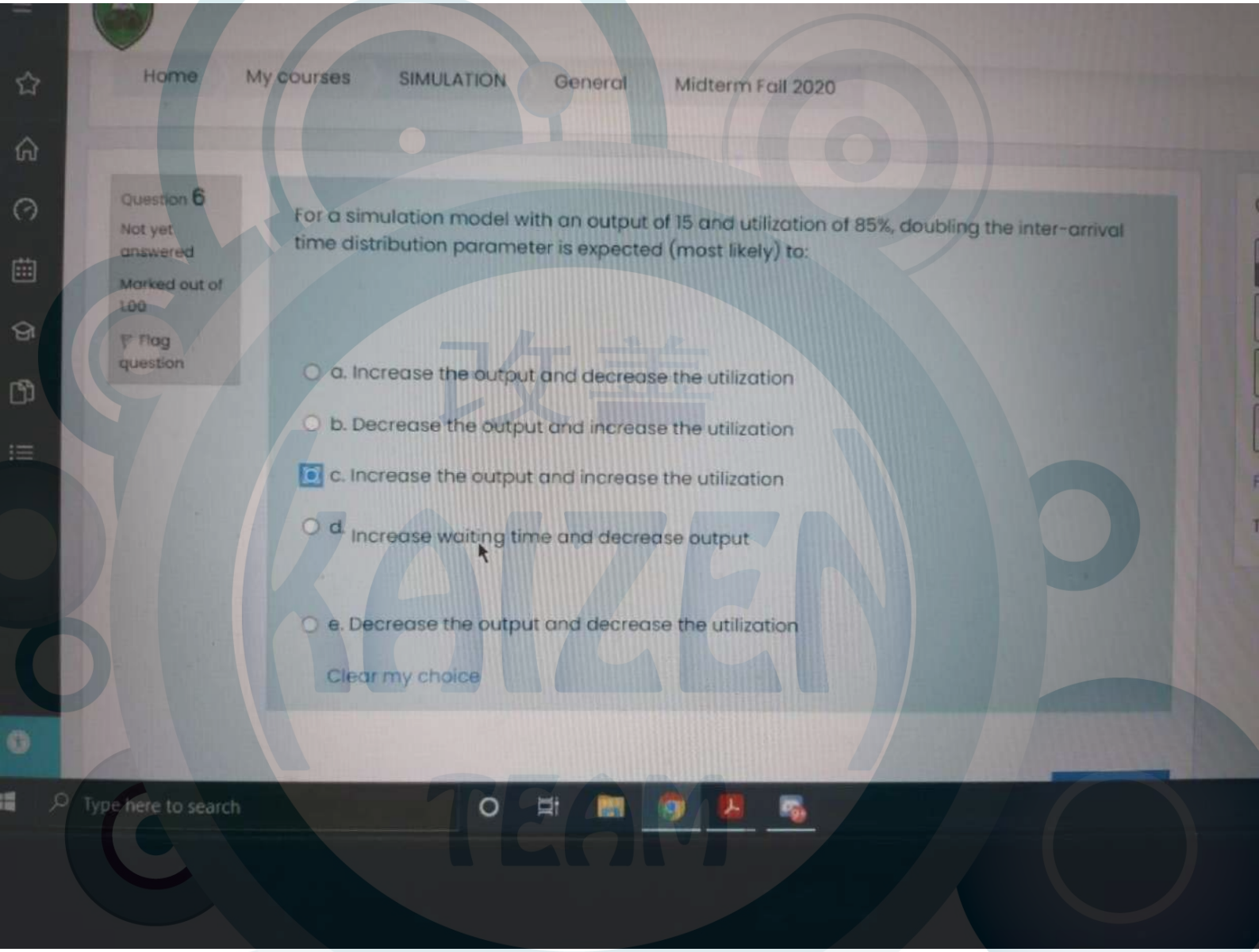
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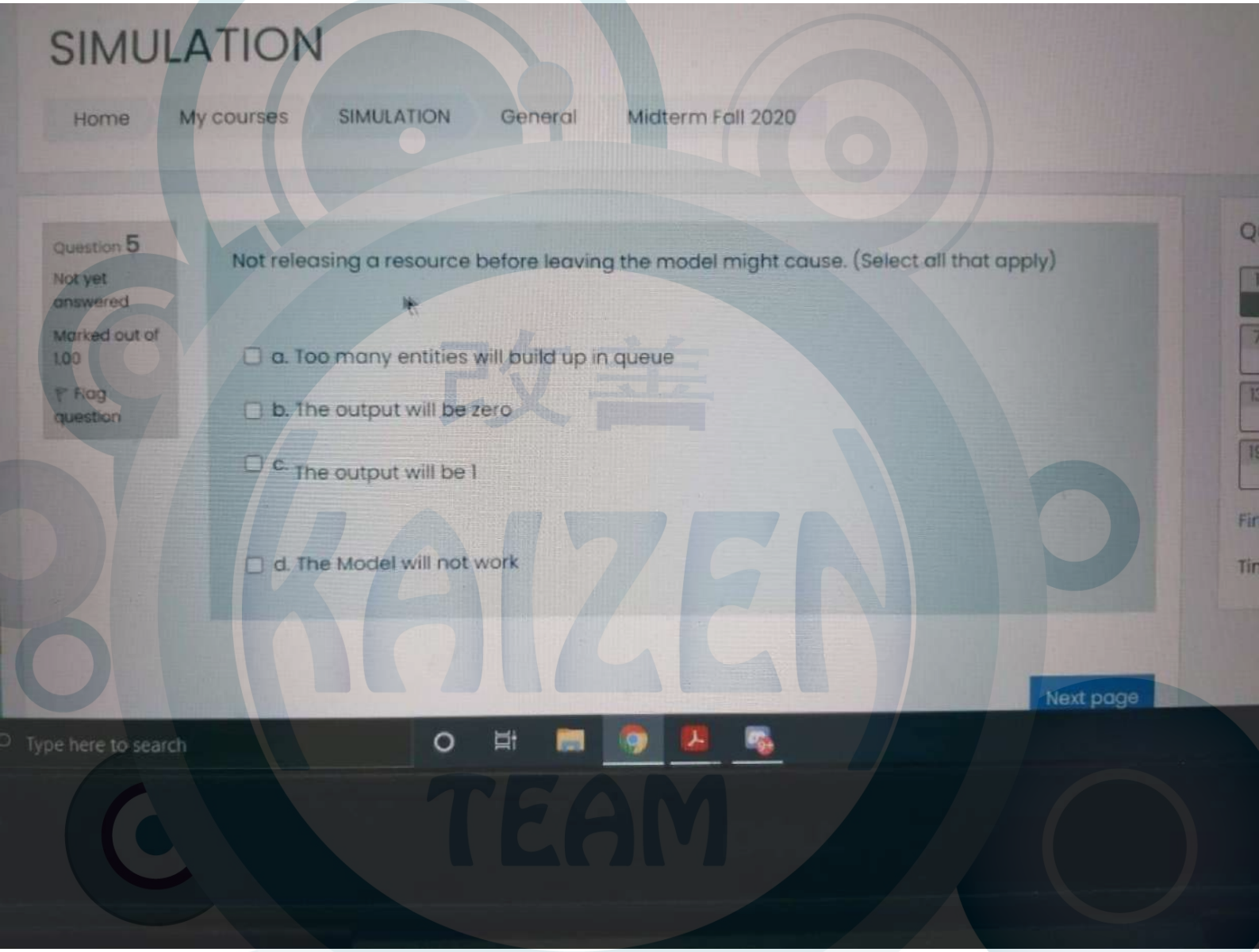
Question 6
Not yet answered
Marked out of 1.00
Flag question
For a simulation model with an output of 15 and utilization of 85%, doubling the inter-arrival time distribution parameter is expected (most likely) to:
a. Increase the output and decrease the utilization
b. Decrease the output and increase the utilization
c. Increase the output and increase the utilization
d. Increase waiting time and decrease output
e. Decrease the output and decrease the utilization
Clear my choice
Type here to search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Question 5
Not yet answered
Marked out of 1.00
Flag question
Not releasing a resource before leaving the model might cause. (Select all that apply)
a. Too many entities will build up in queue
b. The output will be zero
c. The output will be 1
d. The Model will not work
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Just- Finished Event			Variables		Statistical Accumulators									Event Calendar		
Entity No.	Time t	Event Type	$Q(t)$	$B(t)$	P	N	$\sum WQ$	WQ^*	$\sum TS$	TS^*	$\int Q$	Q^*	$\int B$	Entity	Time	Type
—	0	Int	0	0	0	0	0	0	0	0	0	0	0	1 —	0 11.5	arr end
1	0	arr	0	1	0	1	0	0	0	0	0	0	0	2 1	1 3	arr d.p
2	1	arr	1	1	0	1	0	0	0	0	0	1	1	1 3	3 5.6	d.p arr
1	3	d.p	0	1	1	2	2	2	3	3	2	1	3	2 3	5.1 5.6	d.p arr
2	5.1	d.p	0	0	2	3	2	2	7.1	4.1	2	1	3	3	5.6	arr
3	5.6	arr	0	1	2	3	2	2	7.1	4.1	2	1	3	3 4	6.5 7.1	d.p arr
3	6.5	d.p	0	0	3	4	2	2	8	4.1	2	1	3.4	4	9.1	arr
4	9.1	arr	0	1	3	4	2	2	8	4.1	2	1	3.4	4	9.7	d.p
4	9.7	d.p	0	0	4	5	2	2	8.6	4.1	2	1	4.5	5	11.3	arr
5	11.3	arr	0	1	4	5	2	2	8.6	4.1	2	1	4.5	5 6	11.7 11.3	d.p arr
—	11.5	end	0	1	4	5	(2)	(2)	8.6	4.1	2	1	4.7			

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Question 5

Not yet answered

Marked out of 1.00

Flag question

Not releasing a resource before leaving the model might cause. (Select all that apply)

- [x] a. Too many entities will build up in queue
- [ ] b. The output will be zero
- [ ] c. The output will be 1
- [ ] d. The Model will not work

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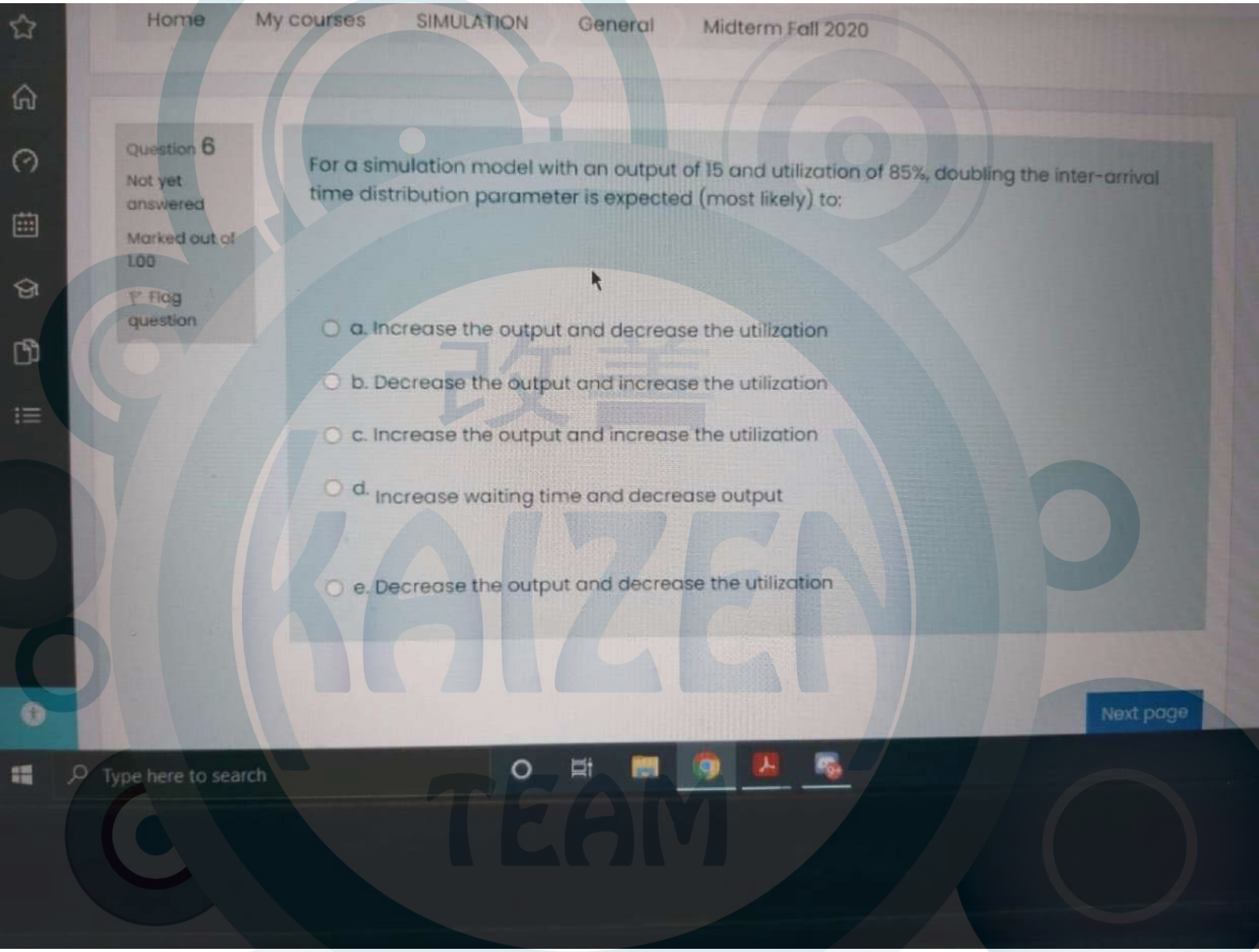
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b. Decrease the output and increase the utilization
c. Increase the output and increase the utilization
d. Increase waiting time and decrease output
e. Decrease the output and decrease the utilization
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b. Service times - exponential, independent of interarrivals
c. Must have E(service) < E(interarrival)
d. Should be at Steady state
Clear my choice
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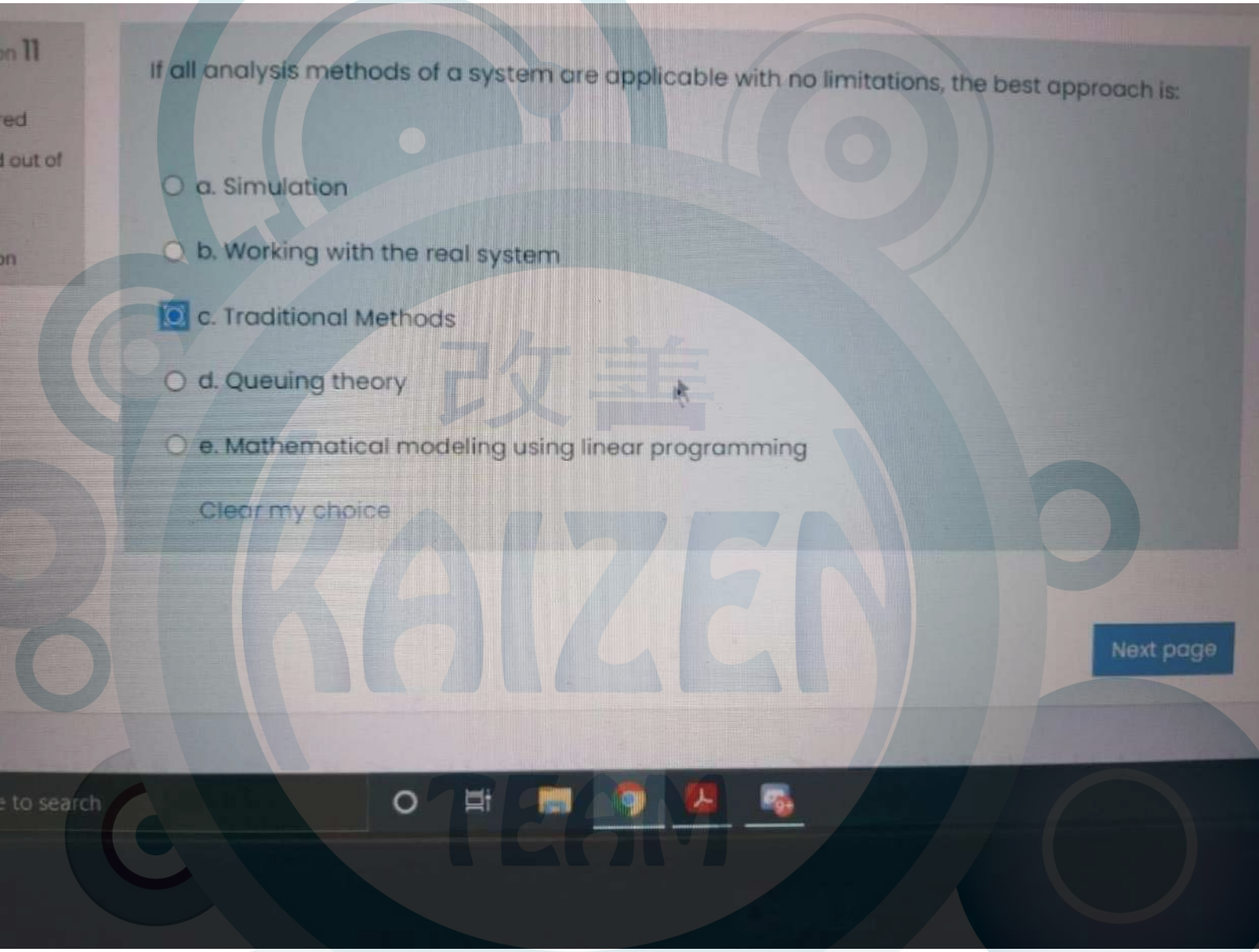
on 11
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If all analysis methods of a system are applicable with no limitations, the best approach is:
a. Simulation
b. Working with the real system
c. Traditional Methods
d. Queuing theory
e. Mathematical modeling using linear programming
Clear my choice
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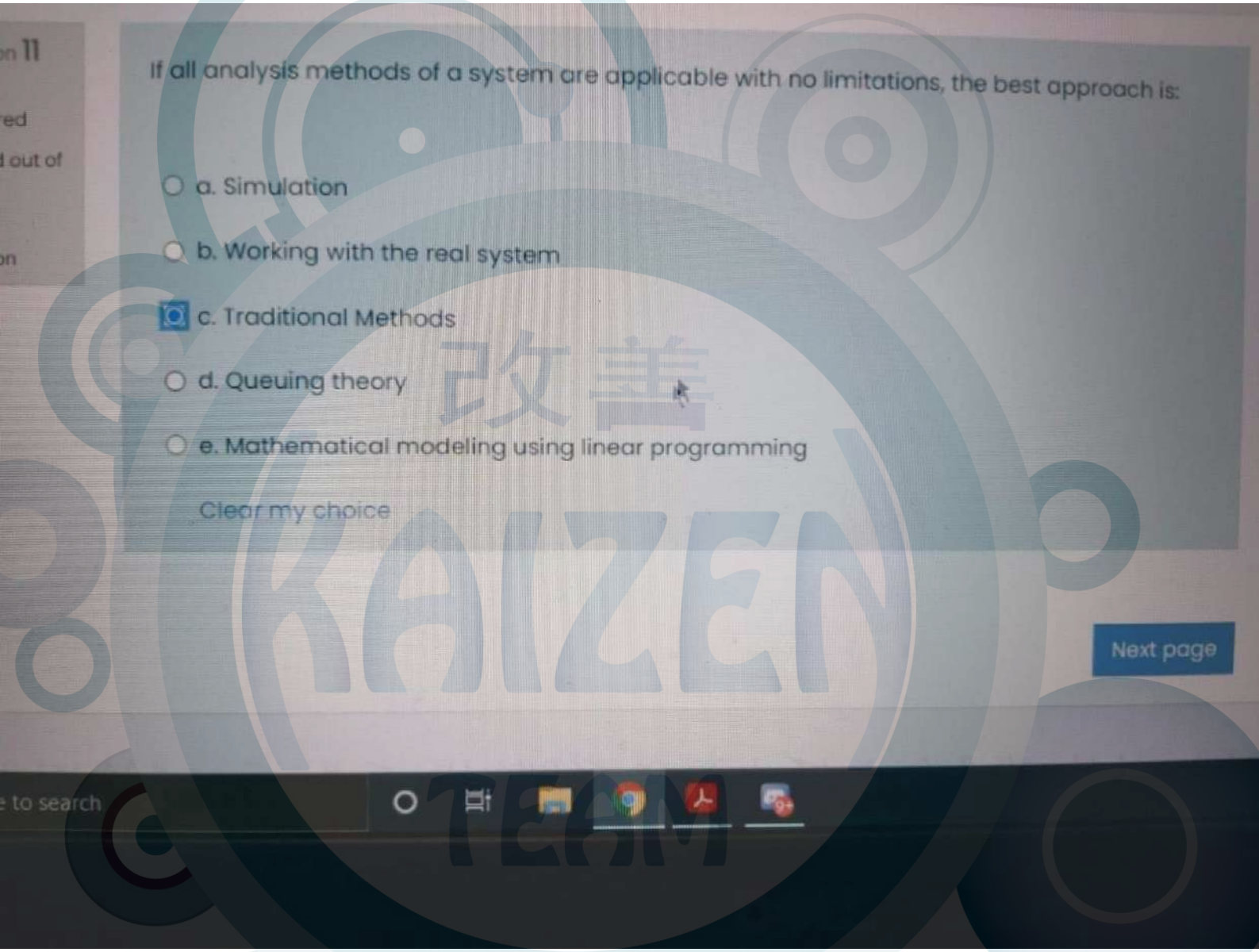
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Clear my choice
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generated random numbers for both inter-arrival
generator (time is in minutes). Assume that the cafeteria starts working in the morning
no students in the system, and the worker is waiting for the first student who arrives rig
when the cafeteria opens, i.e. at time 0). Use the data provided below to perform a ha
simulation for the first 11.5 minutes.

What is the total time in the system?

Customer number	Inter-arrival Time	Service Time
1	1	3
2	4.6	2.1
3	3.5	1.4
4	2.2	3.2
5	3	2.03

Answer: 11.7

Question 22

Not yet answered

Marked out of 1.00

Flag question

Patients arrive at a clinic where one physician (Doctor) takes care of them. Assuming that patients arrive one at a time, and the queue discipline is **First-In-First-Out**. Inter-arrival and service time values were generated from appropriate distributions, as shown in the table below (Time is in minutes). The clinic starts empty and idle. The first customer arrives after 0.5 minutes of the clinic's opening. Use the data provided below to perform a hand simulation for the first 7 minutes and answer the following questions.

How long the patient should expect to wait in the queue?

Patient	Inter-arrival Time	Service Time
1	0.7	1.2
2	0.4	0.6
3	0.6	2.1
4	1.2	3.0
5	2.0	1.4
6	1.2	0.5
7	1.0	1.3
8	0.5	1.1
9	3.1	0.5

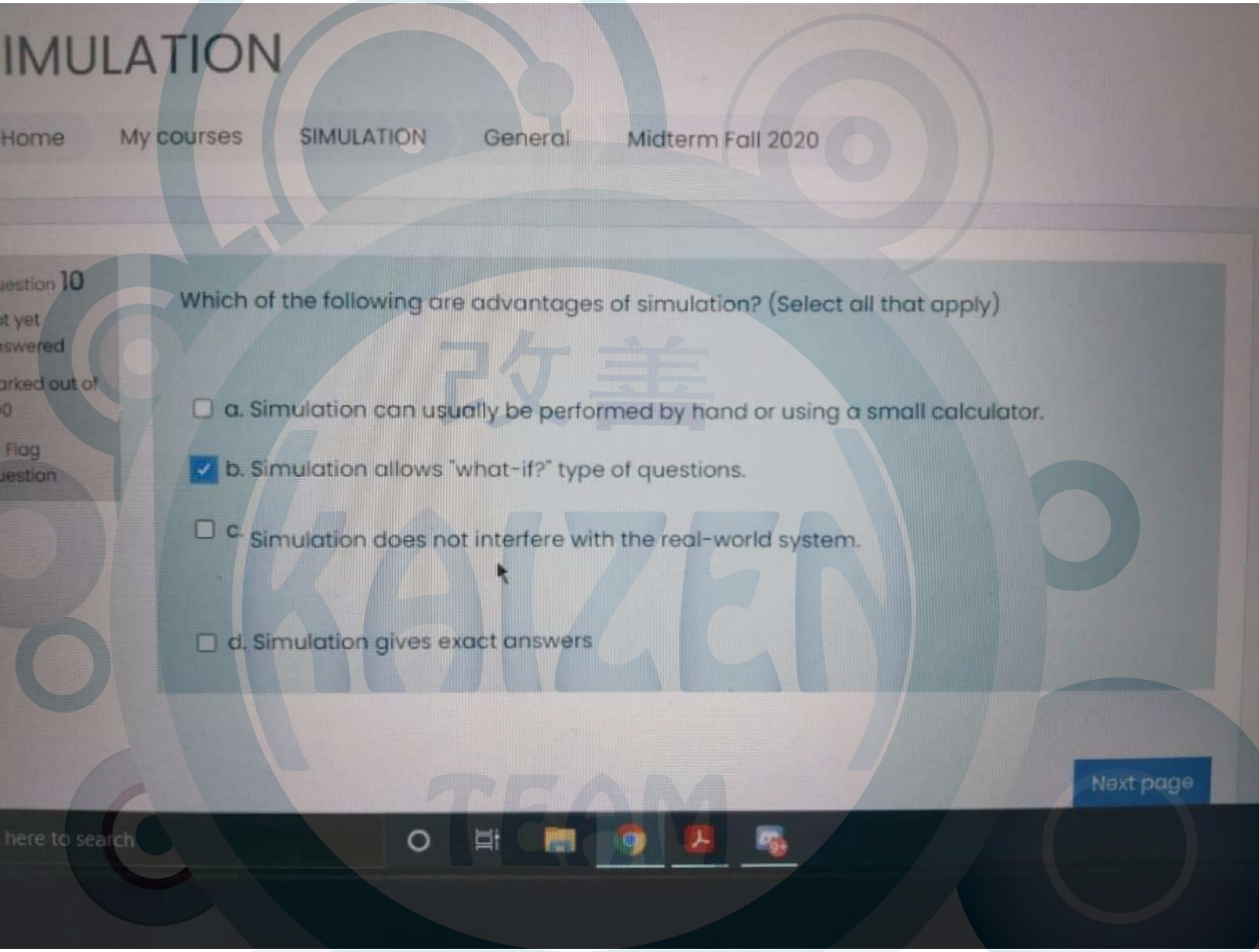
Answer: 0.85

generator (time is in minutes). Assume that the cafeteria starts working in the n
no students in the system, and the worker is waiting for the first student who arr
when the cafeteria opens, i.e. at time 0). Use the data provided below to perform
simulation for the first 11.5 minutes.

What is the maximum waiting time in the queue?

Customer number	Inter-arrival Time	Service Time
1	1	3
2	4.6	2.1
3	3.5	1.4
4	2.2	3.2
5	3	2.03

Answer: 2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uestion
Which of the following are advantages of simulation? (Select all that apply)
a. Simulation can usually be performed by hand or using a small calculator.
b. Simulation allows "what-if?" type of questions.
c. Simulation does not interfere with the real-world system.
d. Simulation gives exact answers
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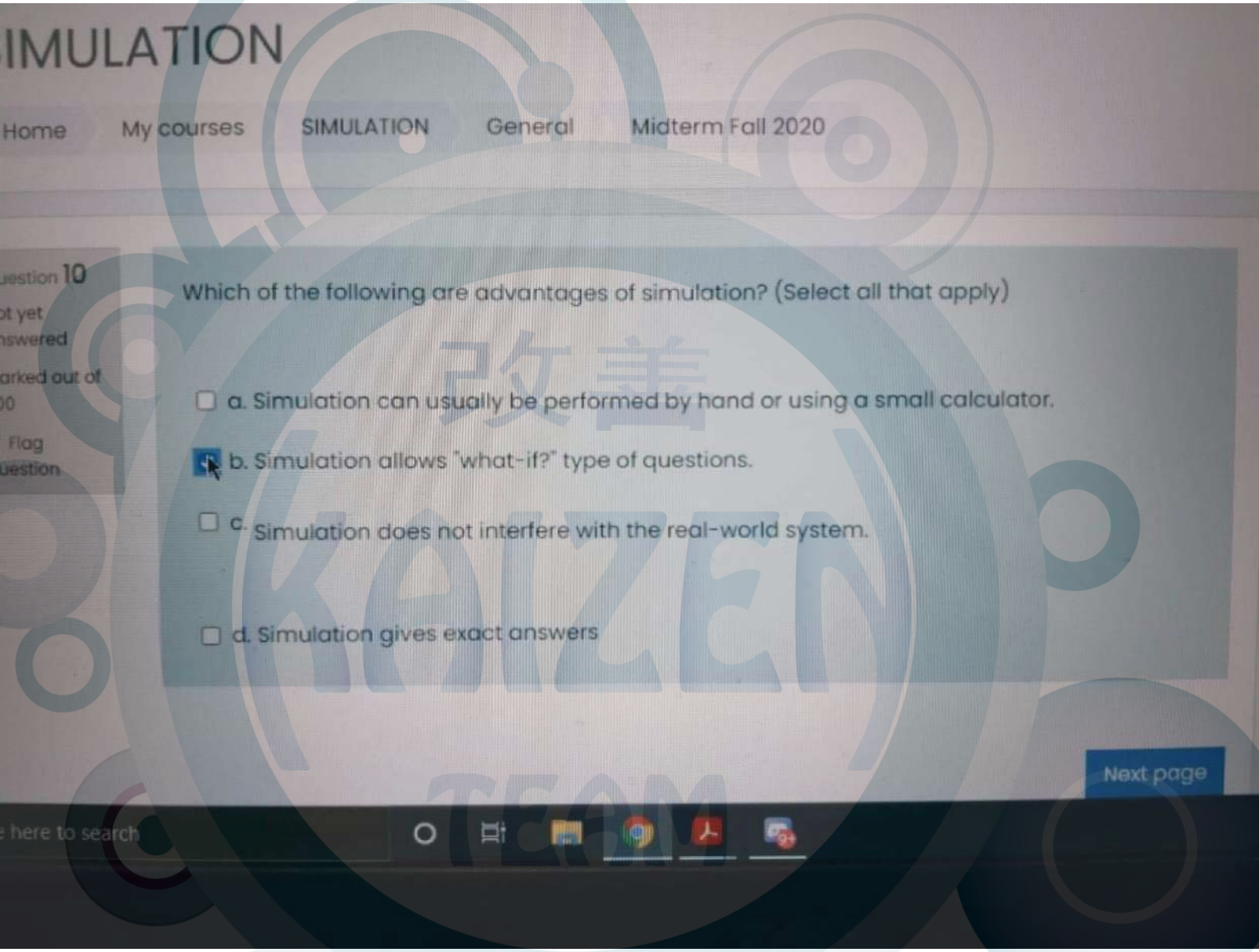
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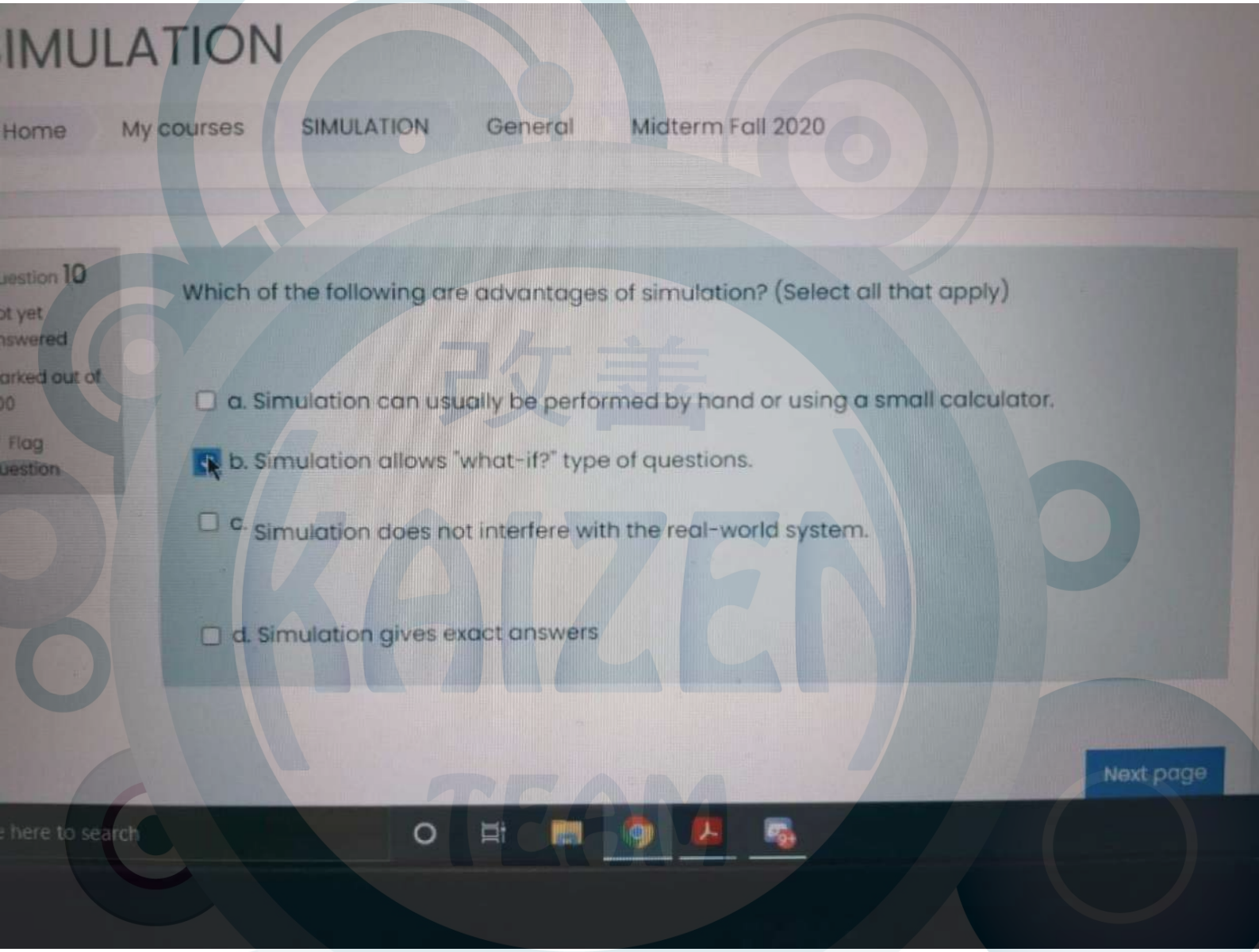
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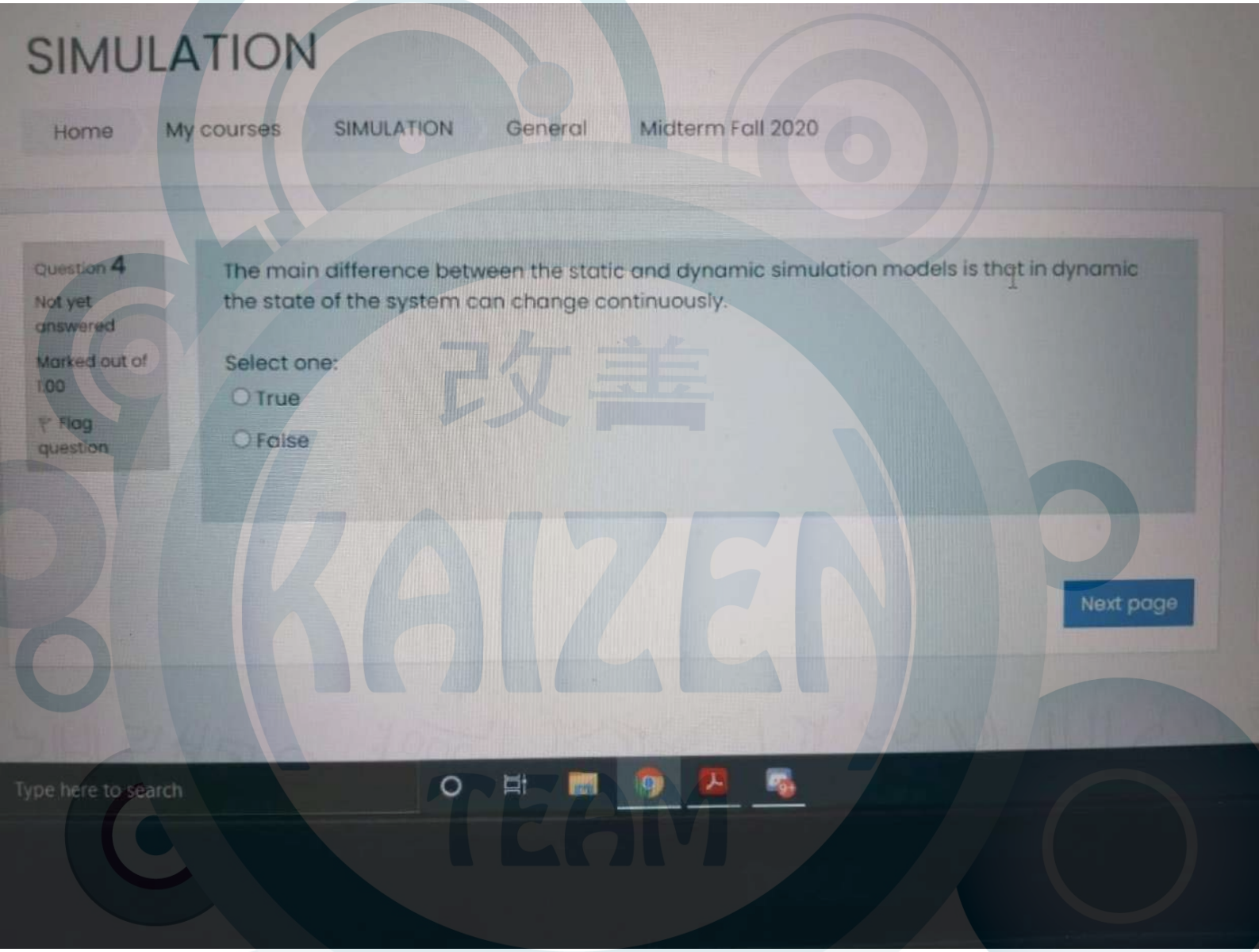
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Question 4
Not yet answered
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Flag question
The main difference between the static and dynamic simulation models is that in dynamic the state of the system can change continuously.
Select one:
True
False
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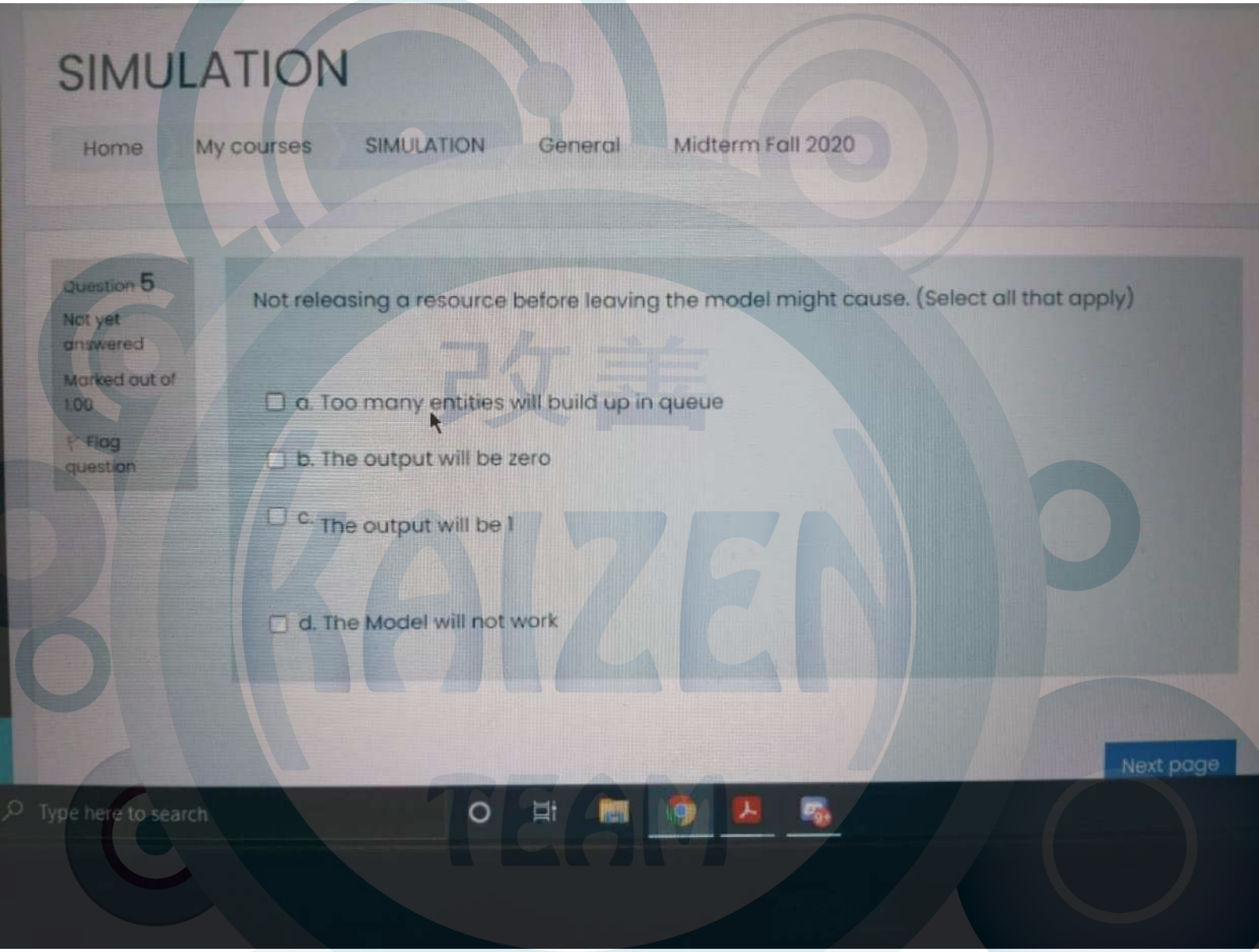
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Question 5
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Flag question
Not releasing a resource before leaving the model might cause. (Select all that apply)
a. Too many entities will build up in queue
b. The output will be zero
c. The output will be 1
d. The Model will not work
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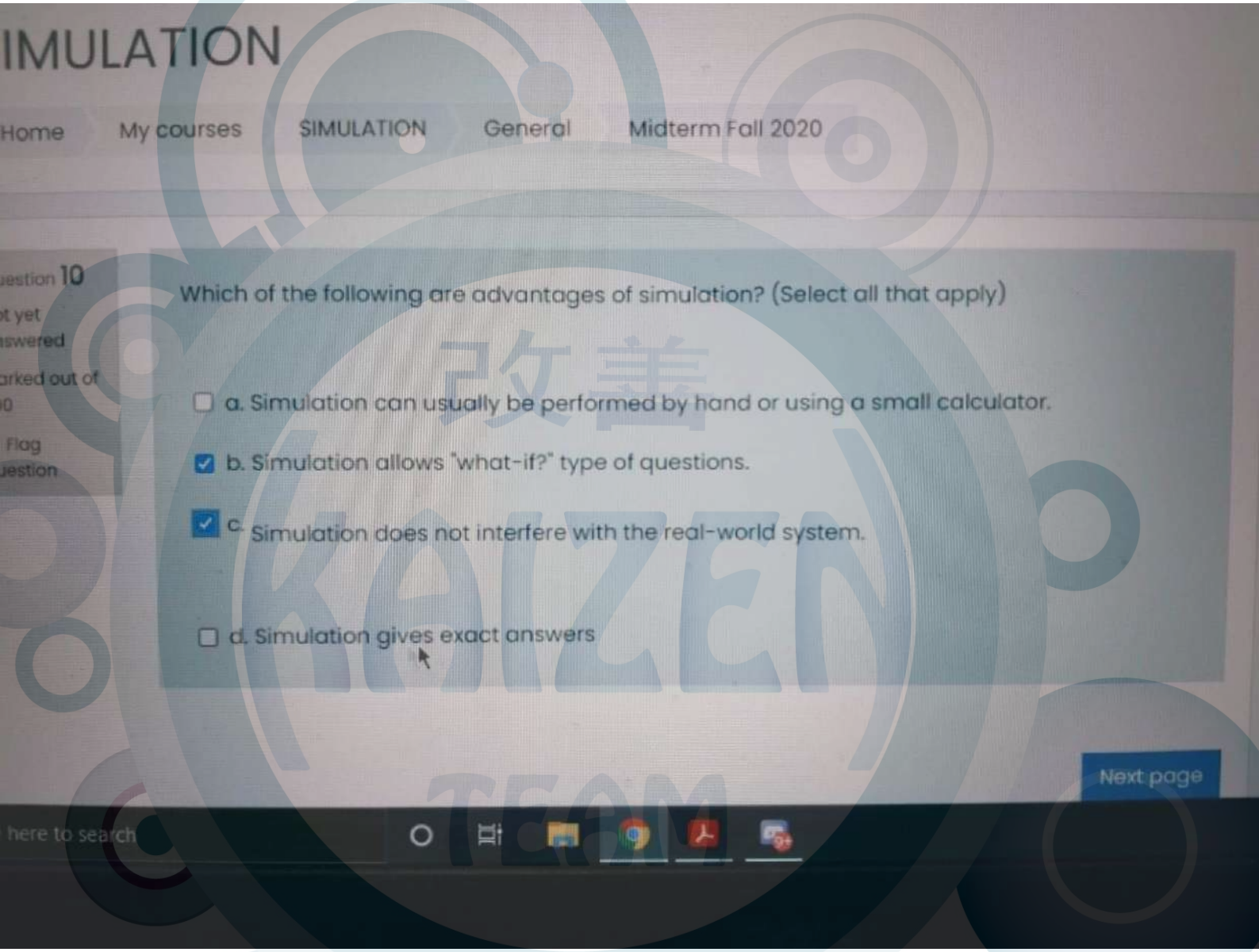
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Which of the following are advantages of simulation? (Select all that apply)
a. Simulation can usually be performed by hand or using a small calculator.
b. Simulation allows "what-if?" type of questions.
c. Simulation does not interfere with the real-world system.
d. Simulation gives exact answers
Next page
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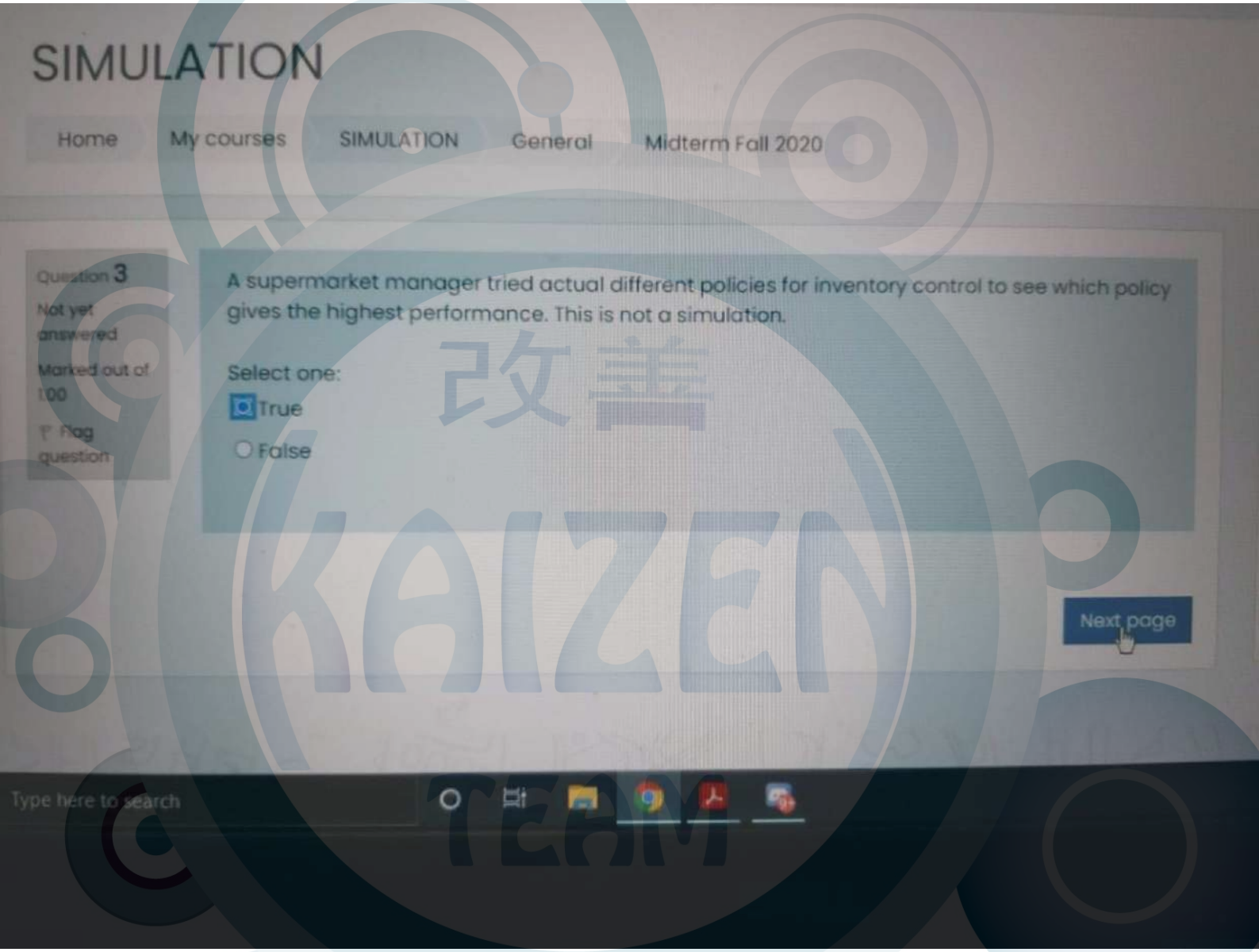
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General
Midterm Fall 2020
Question 3
Not yet answered
Marked out of 1.00
Flag question
A supermarket manager tried actual different policies for inventory control to see which policy gives the highest performance. This is not a simulation.
Select one:
True
False
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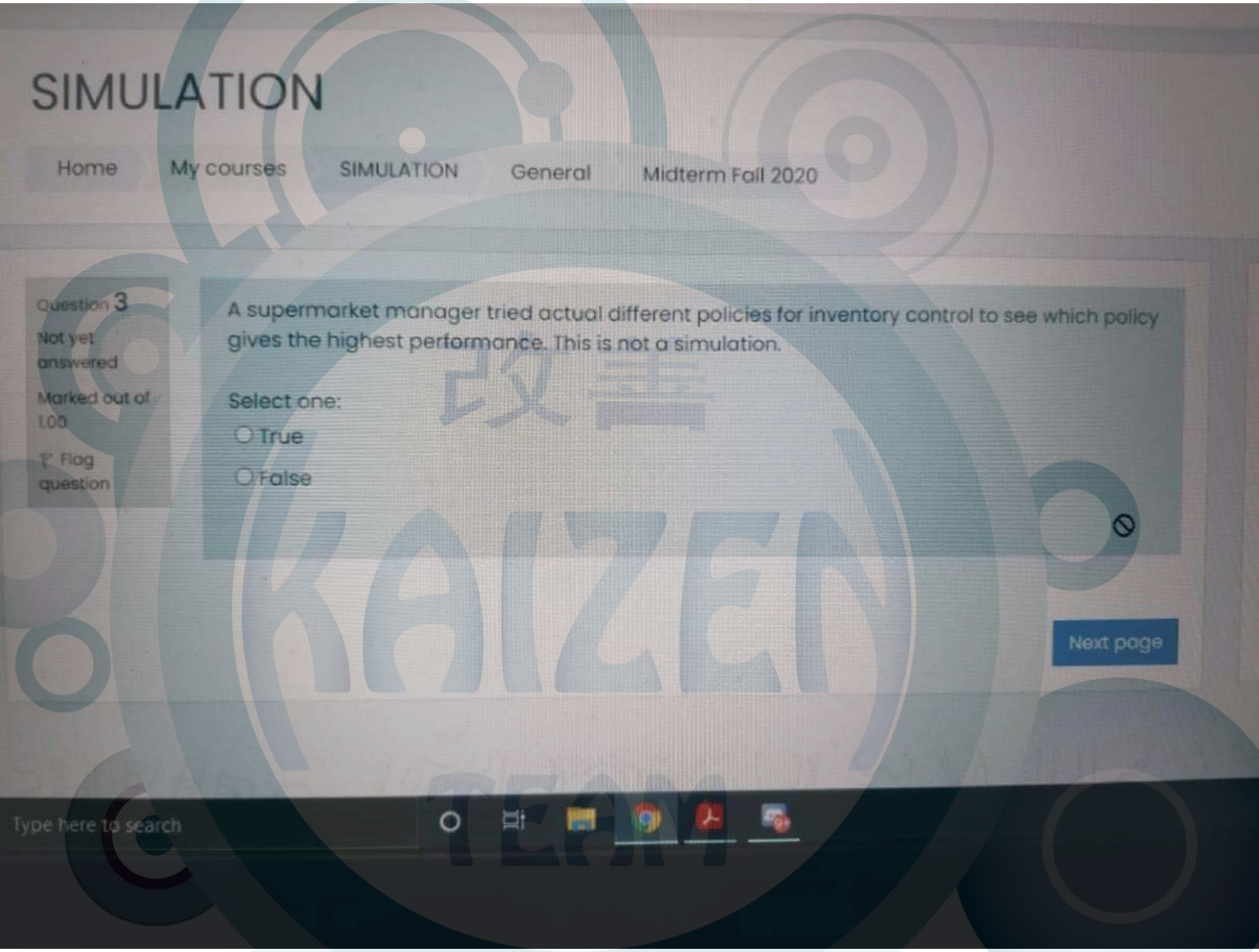
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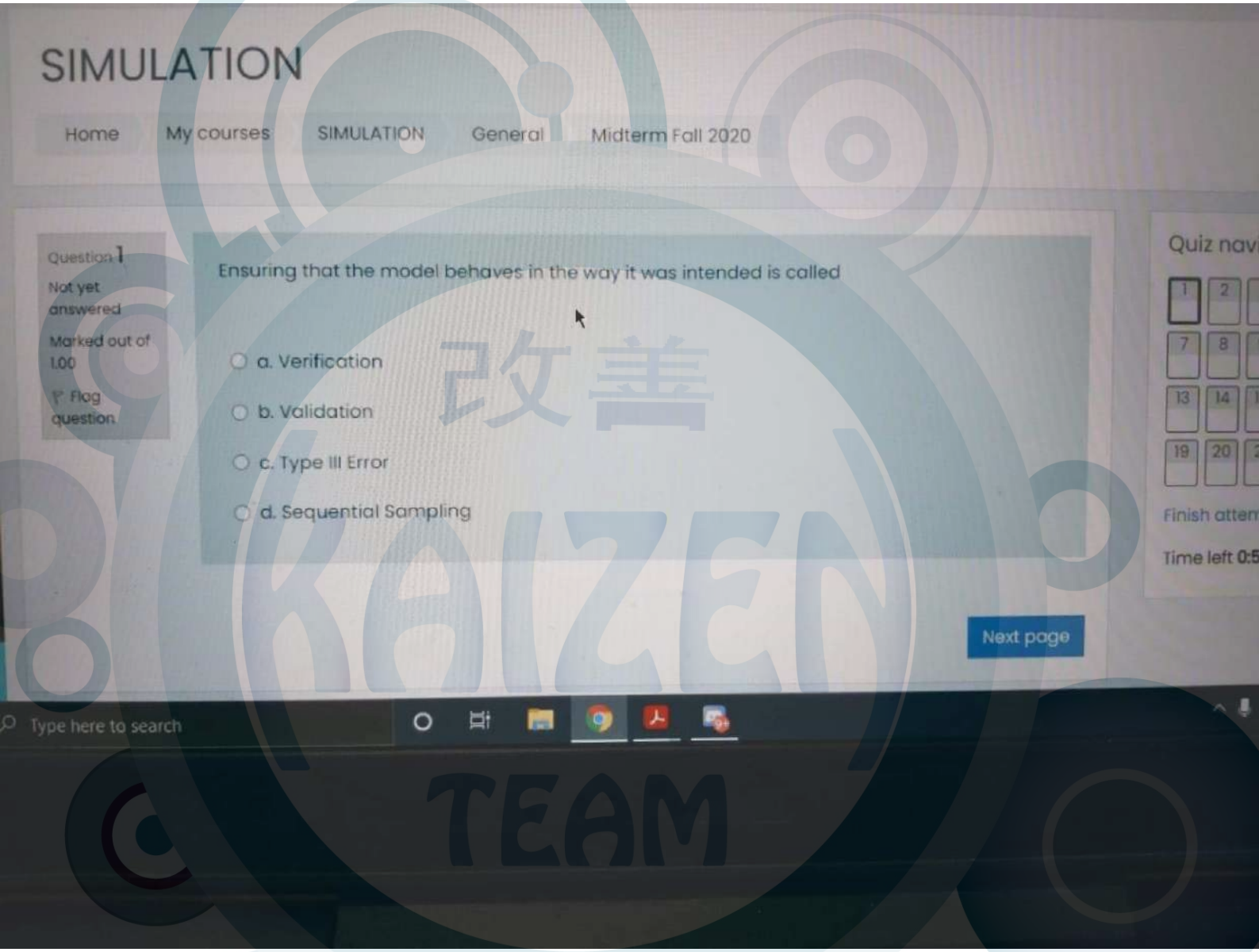
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Question 1
Not yet answered
Marked out of 1.00
Flag question
Ensuring that the model behaves in the way it was intended is called
a. Verification
b. Validation
c. Type III Error
d. Sequential Sampling
Quiz nav
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Next page
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IMULATION

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Which of the following are advantages of simulation? (Select all that apply)

- [ ] a. Simulation can usually be performed by hand or using a small calculator.
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- [ ] d. Simulation gives exact answers

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SIMULATION

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Question 7

Not yet answered

Marked out of 1.00

Flag question

Repeating the simulation for 4 times with each run for a length of 2 hours will result in a sample size of

Answer: 4

Next page

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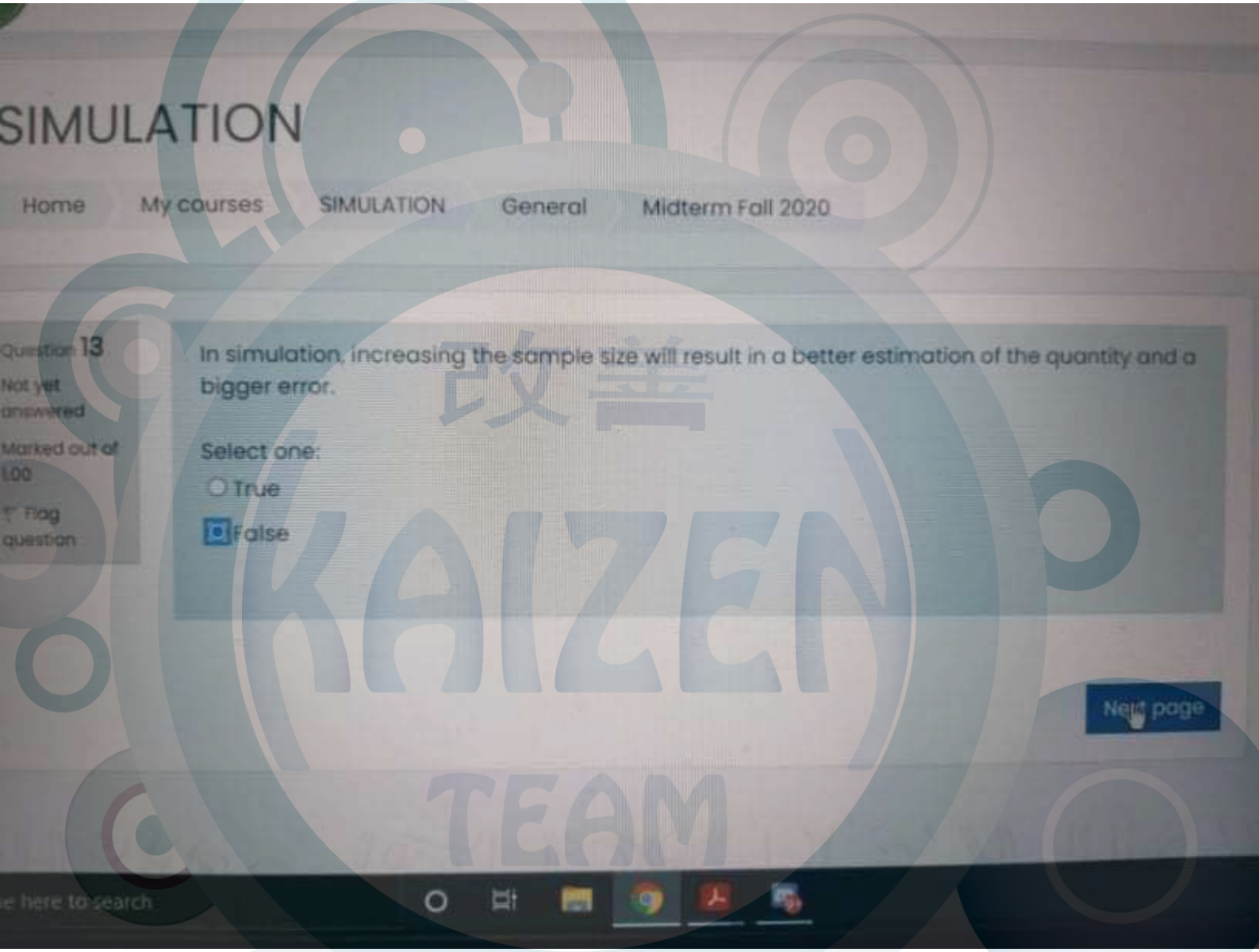
SIMULATION
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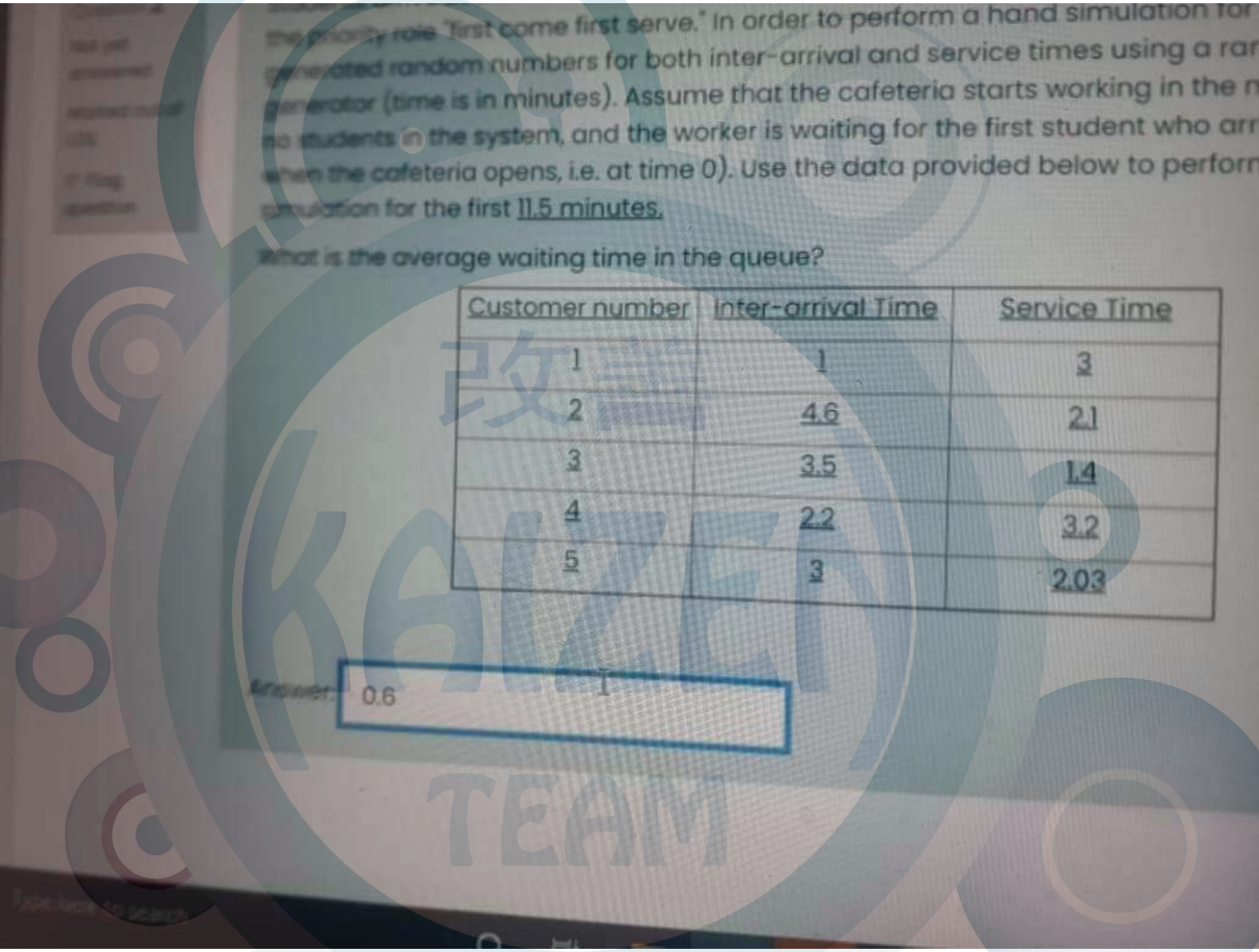
General
Midterm Fall 2020
Question 13
Not yet answered
Marked out of 1.00
Flag question
In simulation, increasing the sample size will result in a better estimation of the quantity and a bigger error.
Select one:
True
False
Next page
KAIZEN
TEAM


the priority rule "first come first serve." In order to perform a hand simulation for
generated random numbers for both inter-arrival and service times using a ran
generator (time is in minutes). Assume that the cafeteria starts working in the m
no students in the system, and the worker is waiting for the first student who arr
when the cafeteria opens, i.e. at time 0). Use the data provided below to perform
simulation for the first 11.5 minutes.
What is the average waiting time in the queue?
Customer number | Inter-arrival Time | Service Time
1 | 1 | 3
2 | 4.6 | 2.1
3 | 3.5 | 1.4
4 | 2.2 | 3.2
5 | 3 | 2.03
Answer: 0.6

Time left 0:52:00

We may have more than one entity type and multiple realizations of the entities in the same system

Select one:

- True
- False

Next page

Time left 0:52:00

We may have more than one entity type and multiple realizations of the entities in the same system

Select one:

- True
- False

Next page

Time left 0:53:3

One of the problems in the Queueing theory analysis approach in queuing systems is the time frame, which is due to the assumption

- a. Service times ~ exponential, independent of inter-arrivals
- b. Steady-state
- c. Must have E(service) < E(inter-arrival)
- d. Inter-arrival times ~ exponential

Clear my choice

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Time left 0:53:3

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Clear my choice

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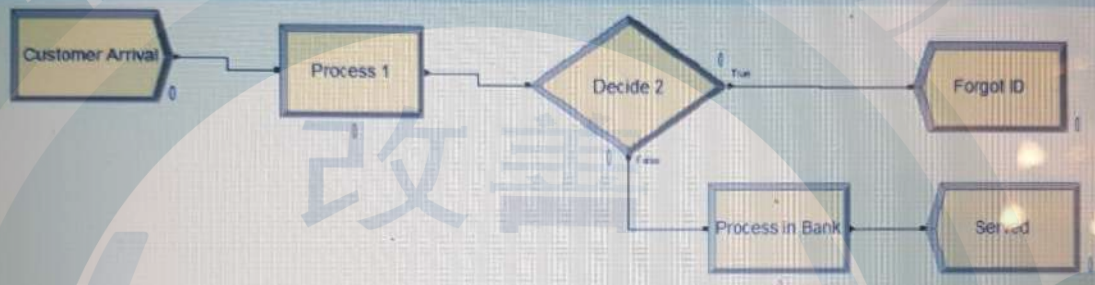
to search

TRIA(2,5,10) minutes.

Time left 0:27:13

Finish a

The model needs necessary modeling to represent the:



- a. Counting number of leaving customers
- b. Shutdown at 3:00pm
- c. Closing incoming doors at 3:00pm
- d. Processing customers after 2:00pm

Next page

TRIA(2,5,10) minutes.

Time left 0:27:13

Finish a

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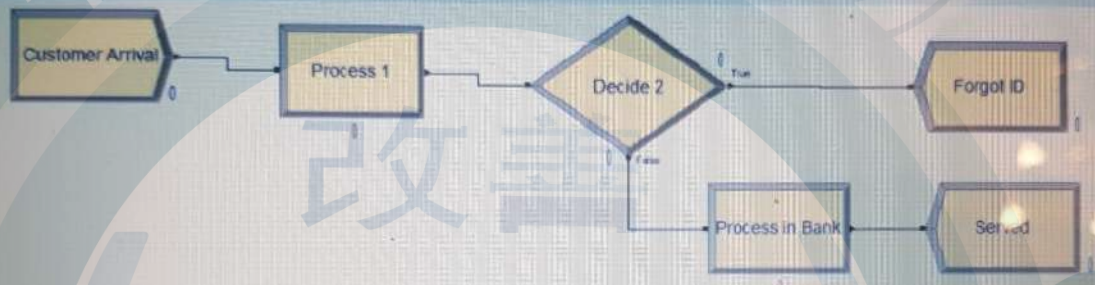

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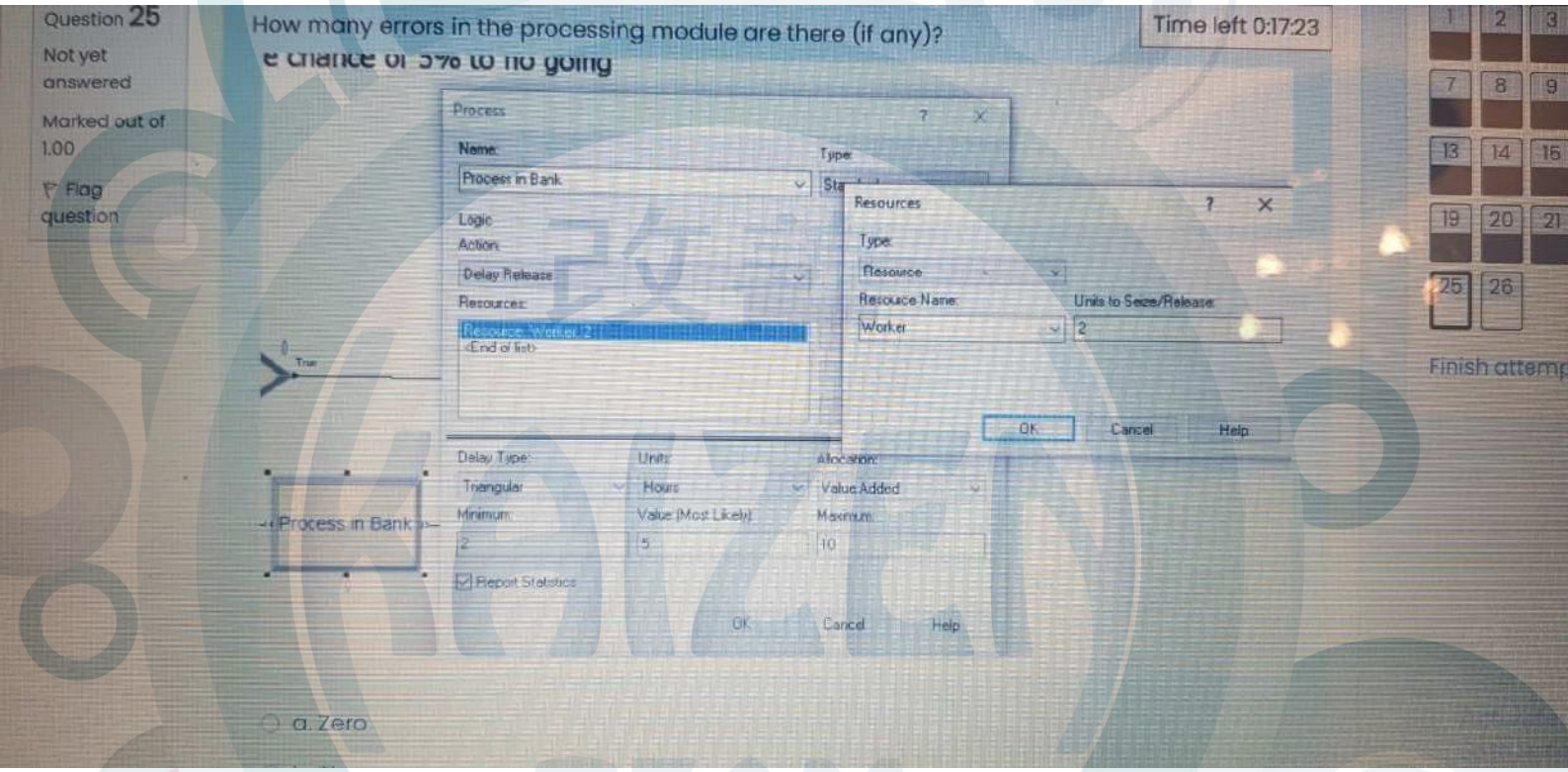
Next page


Question 25
Not yet answered
Marked out of 1.00
Flag question
How many errors in the processing module are there (if any)?
Time left 0:17:23
Process
Name:
Process in Bank
Type:
Logic
Action:
Delay Release
Resources:
Resource: Worker 2
<End of list>
Resources
Type:
Resource
Resource Name:
Worker
Units to Seize/Release:
2
OK
Cancel
Help
Delay Type:
Triangular
Units:
Hours
Allocation:
Value Added
Minimum:
2
Value (Most Likely):
5
Maximum:
10
Report Statistics
OK
Cancel
Help
Process in Bank
a. Zero
Finish attemp

on 7

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A limited storage space is best modeled by

- a. Queue
- b. Resource
- c. Delay
- d. Entity
- e. Variable

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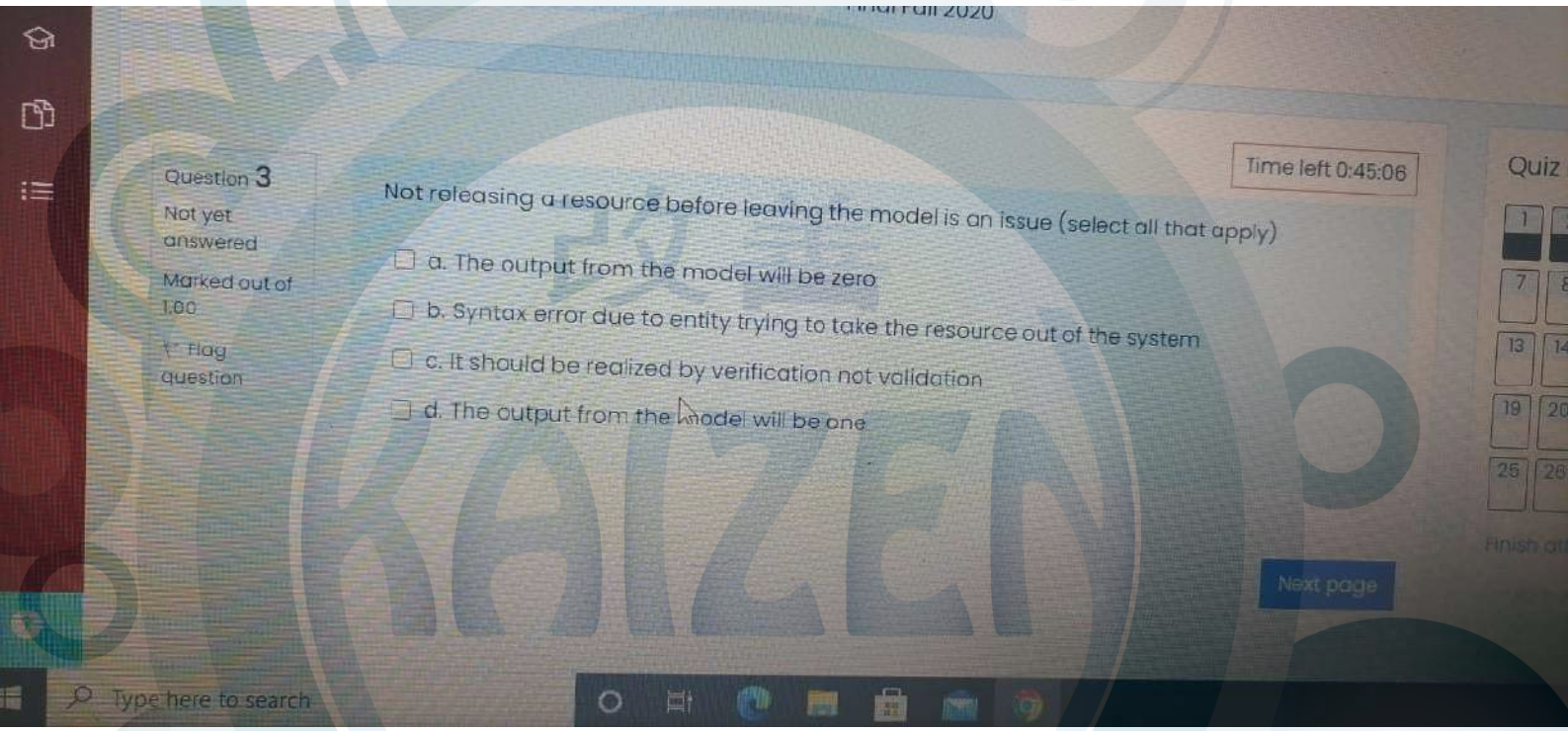
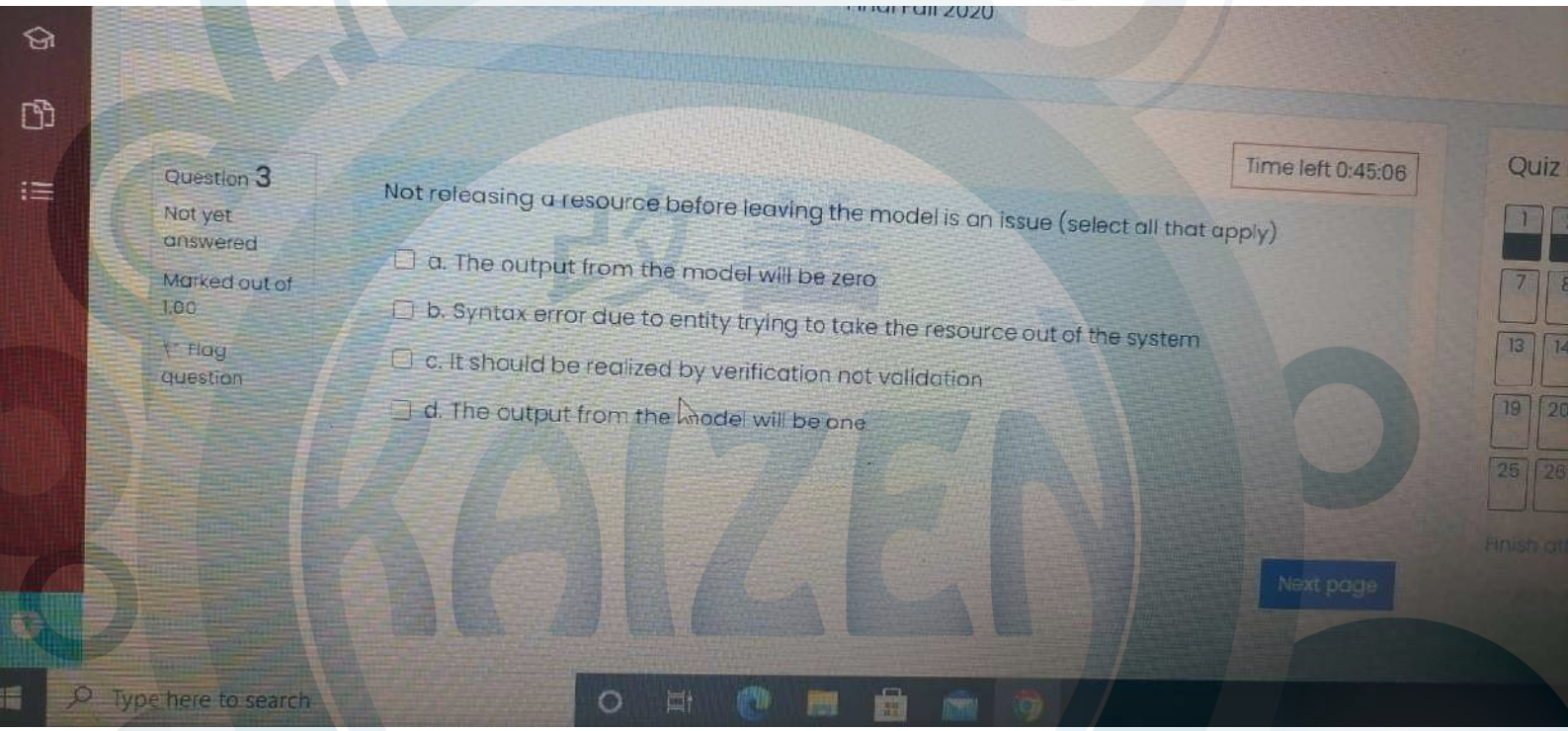

Time left 0:45:06
Question 3
Not yet answered
Marked out of 1.00
Flag question
Not releasing a resource before leaving the model is an issue (select all that apply)
a. The output from the model will be zero
b. Syntax error due to entity trying to take the resource out of the system
c. It should be realized by verification not validation
d. The output from the model will be one
Next page
Type here to search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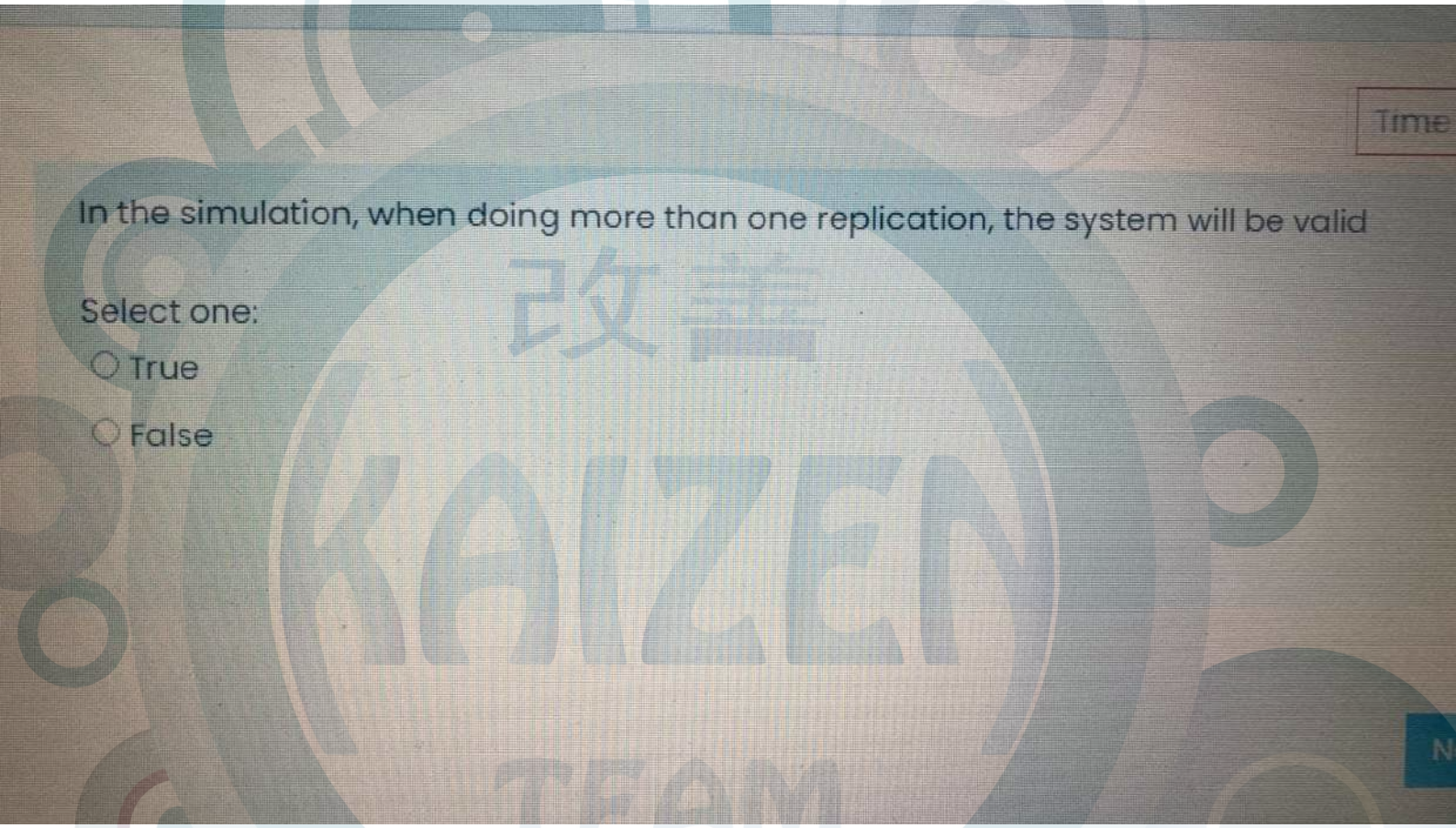
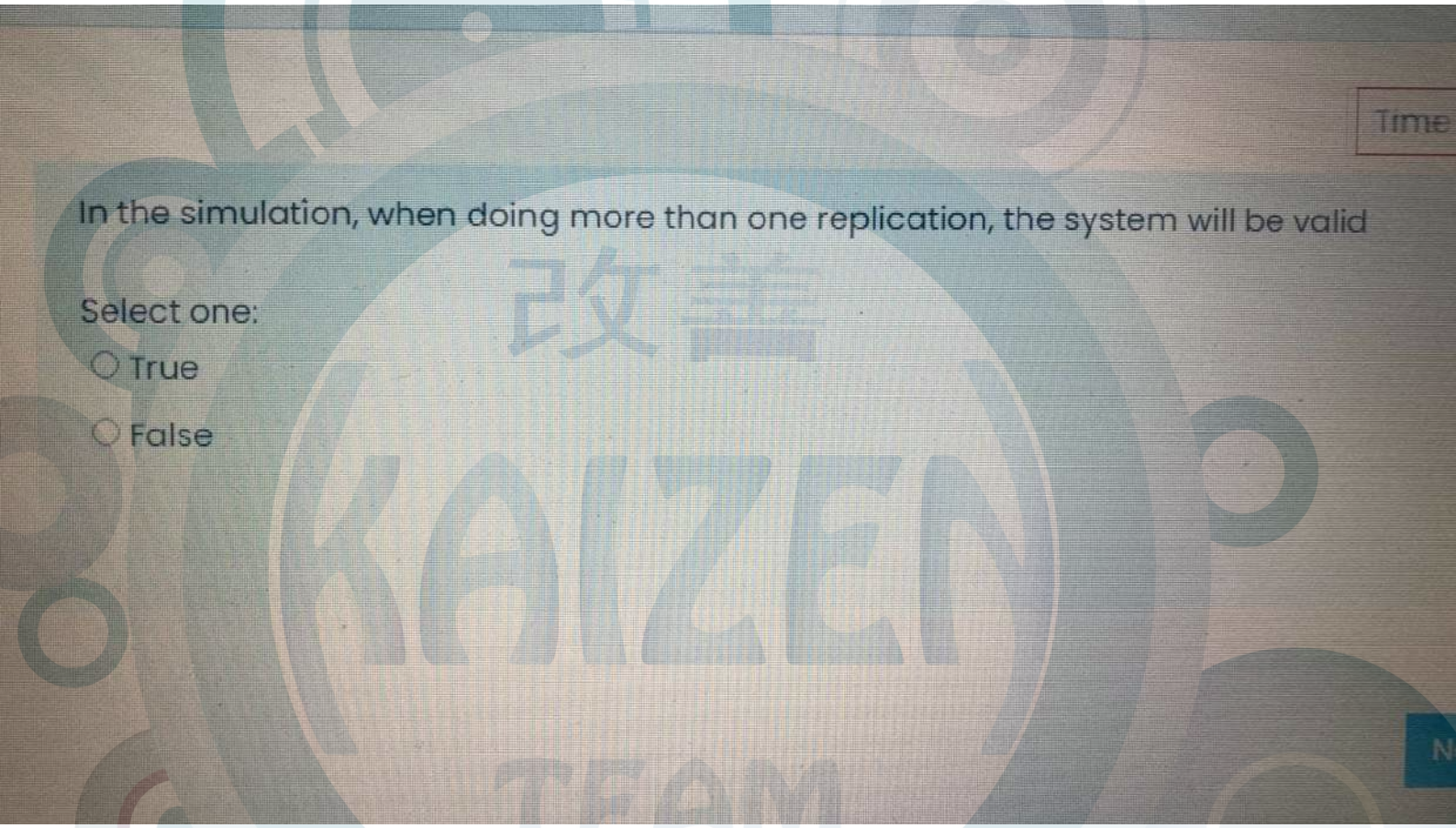

Time
In the simulation, when doing more than one replication, the system will be valid
Select one:
True
False


Time
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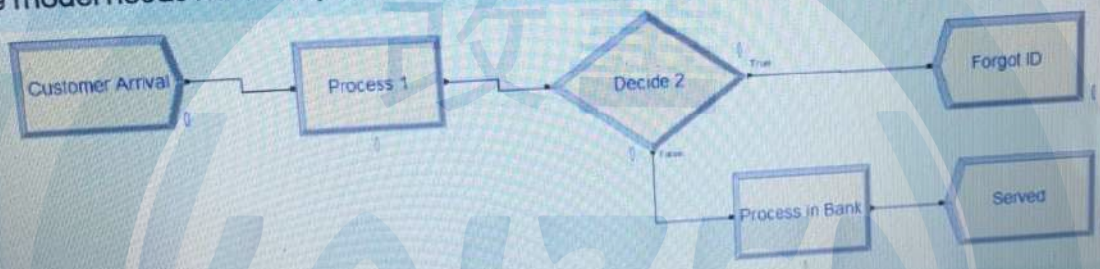
Select one:
True
False

3:00 pm (does not allow anyone in). However, the customers who are already in continue to be served and leave through another door. The Bank will not shut down until all customers are flushed out (given it is 3:00 pm or after). There is just one process in this system that needs one of the 2 workers available to work on it. Incoming customers have the chance of 5% to not going through the process since they forgot their I.D. The process takes TRIA(2,5,10) minutes.

The model needs necessary modeling to represent the:



- a. Counting number of leaving customers
- b. Processing customers after 2:00pm
- c. Closing incoming doors at 3:00pm
- d. Shutdown at 3:00pm

19 20 2
25 26
Finish attem

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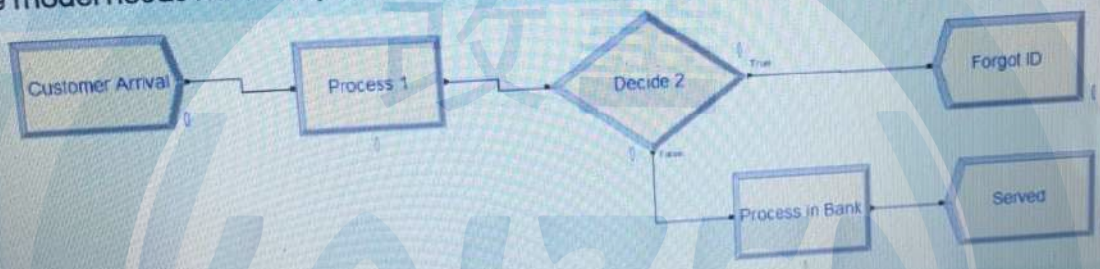

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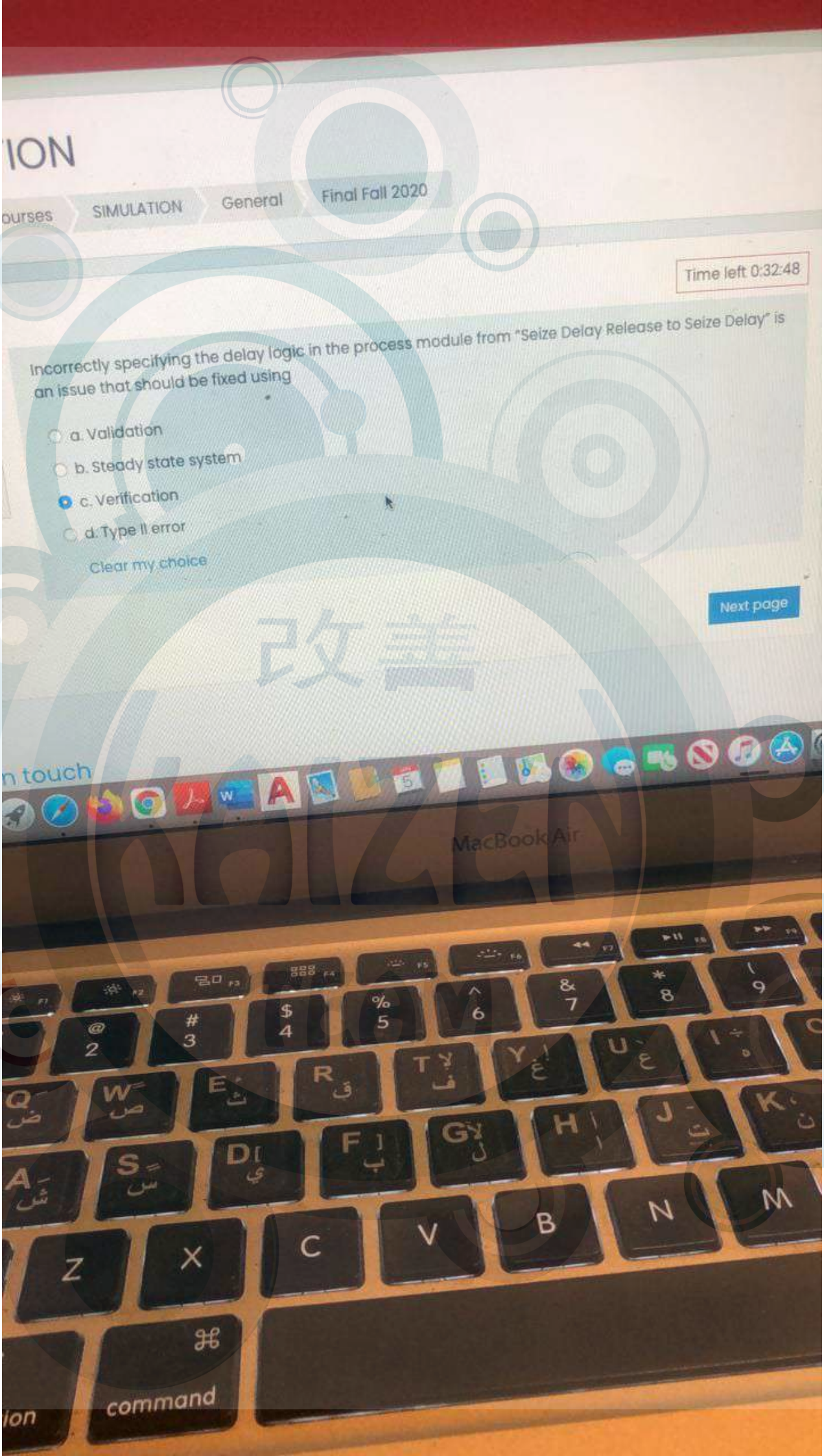
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SIMULATION
General
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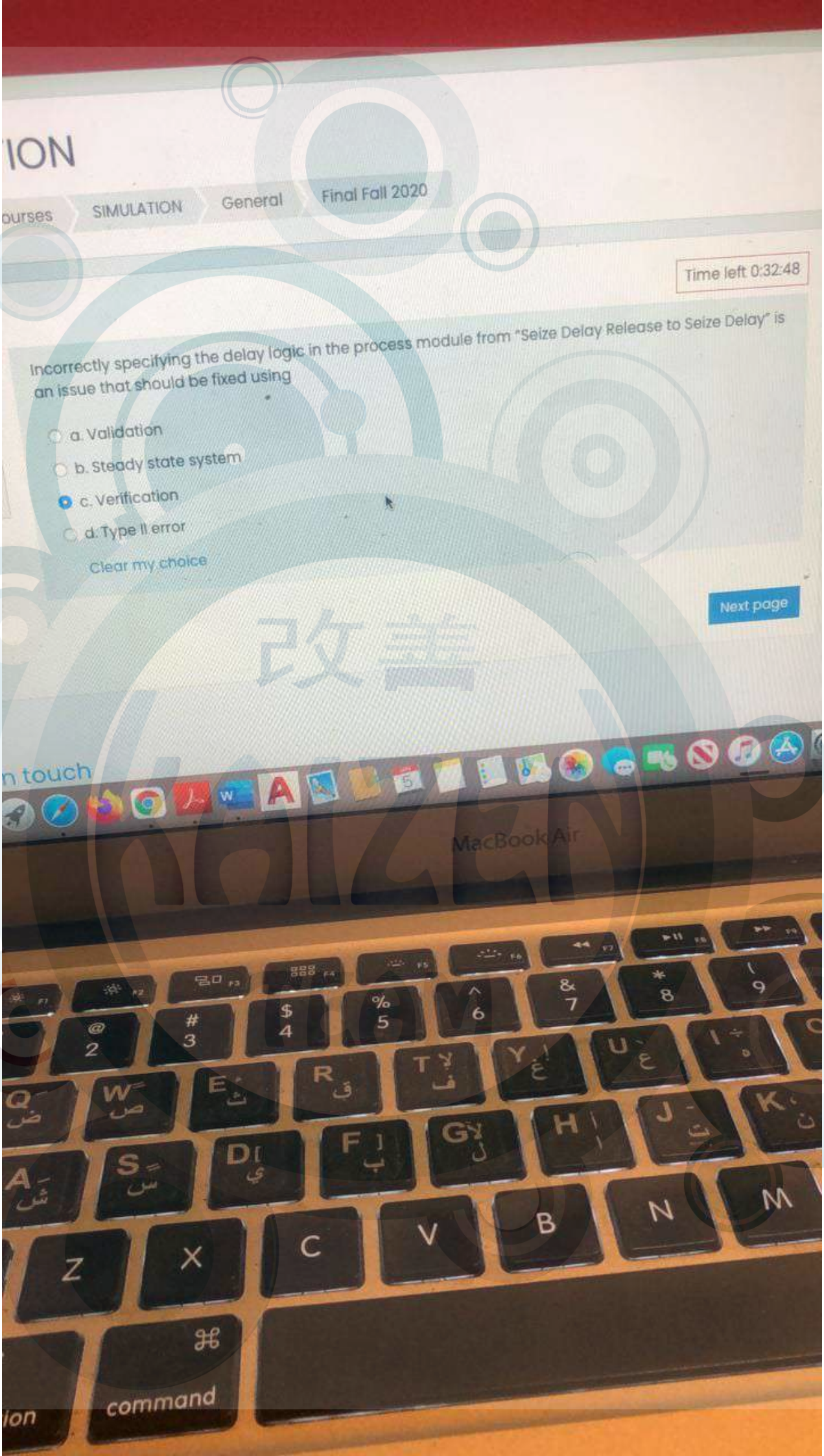
Time left 0:32:48
Incorrectly specifying the delay logic in the process module from "Seize Delay Release to Seize Delay" is an issue that should be fixed using
a. Validation
b. Steady state system
c. Verification
d. Type II error
Clear my choice
Next page
n touch
MacBook Air
command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Next page
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MacBook Air
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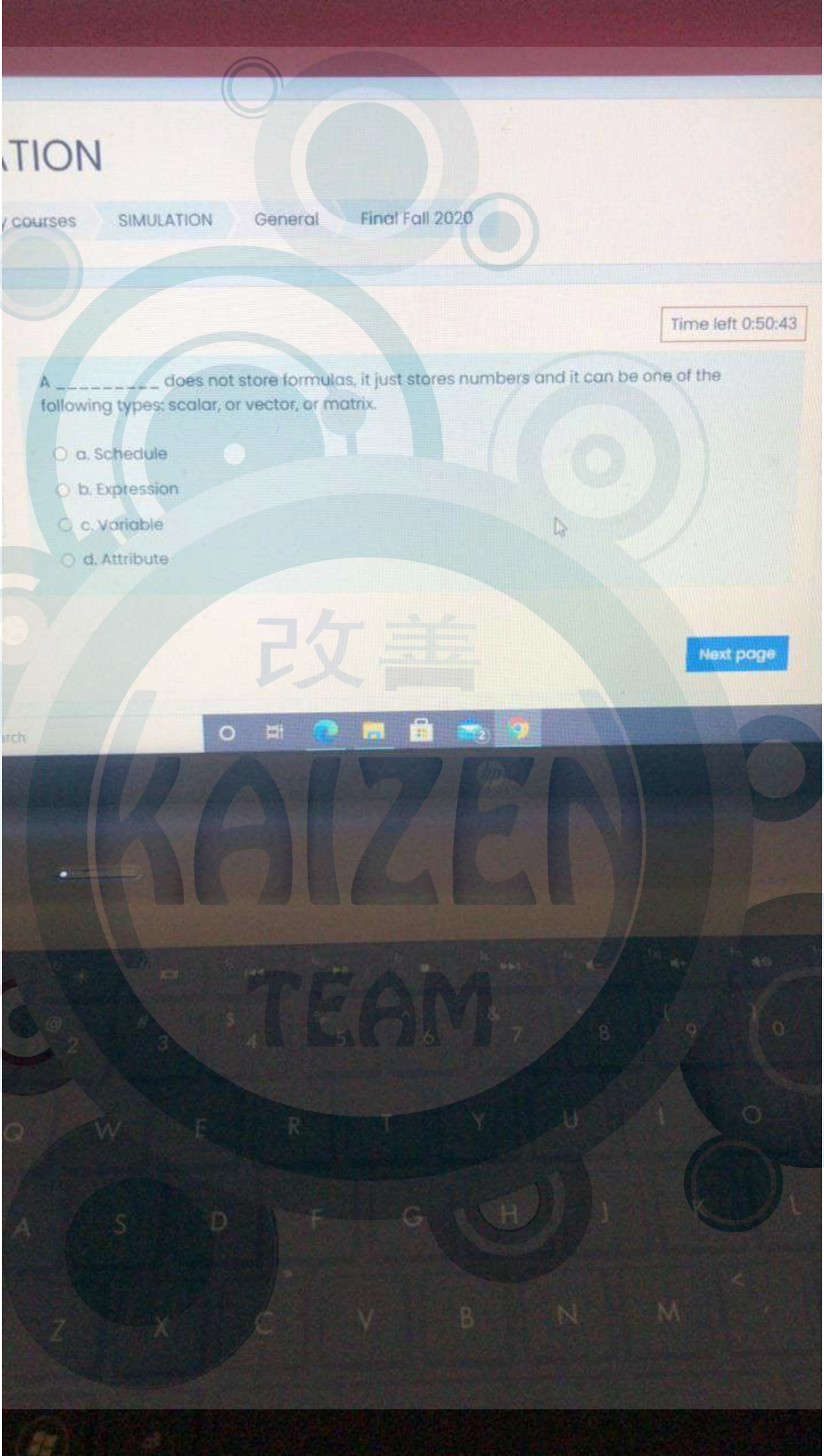
TION
courses
SIMULATION
General
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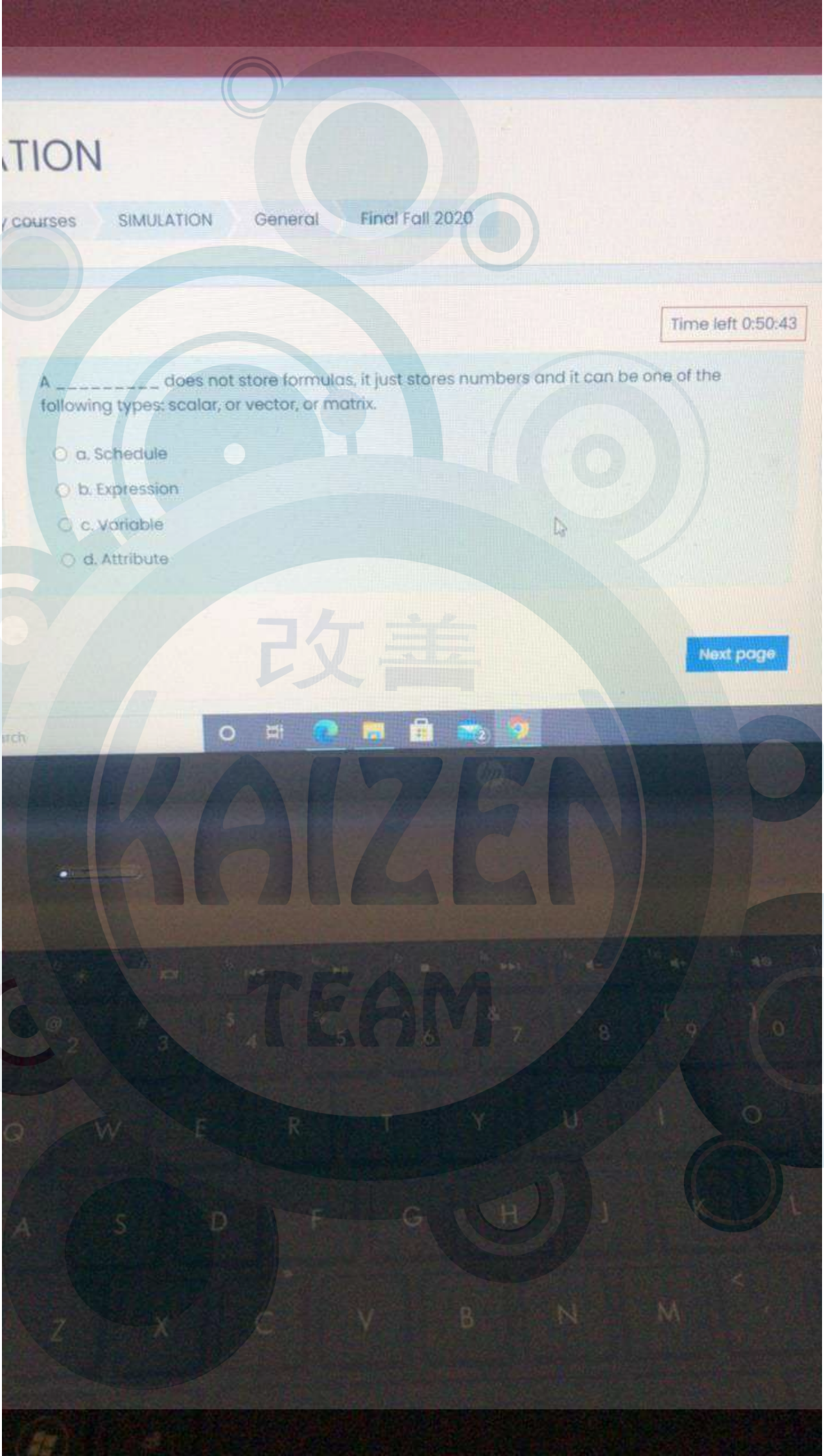
Time left 0:50:43
A _____ does not store formulas, it just stores numbers and it can be one of the following types: scalar, or vector, or matrix.
a. Schedule
b. Expression
c. Variable
d. Attribute
Next page
KAIZEN
TEAM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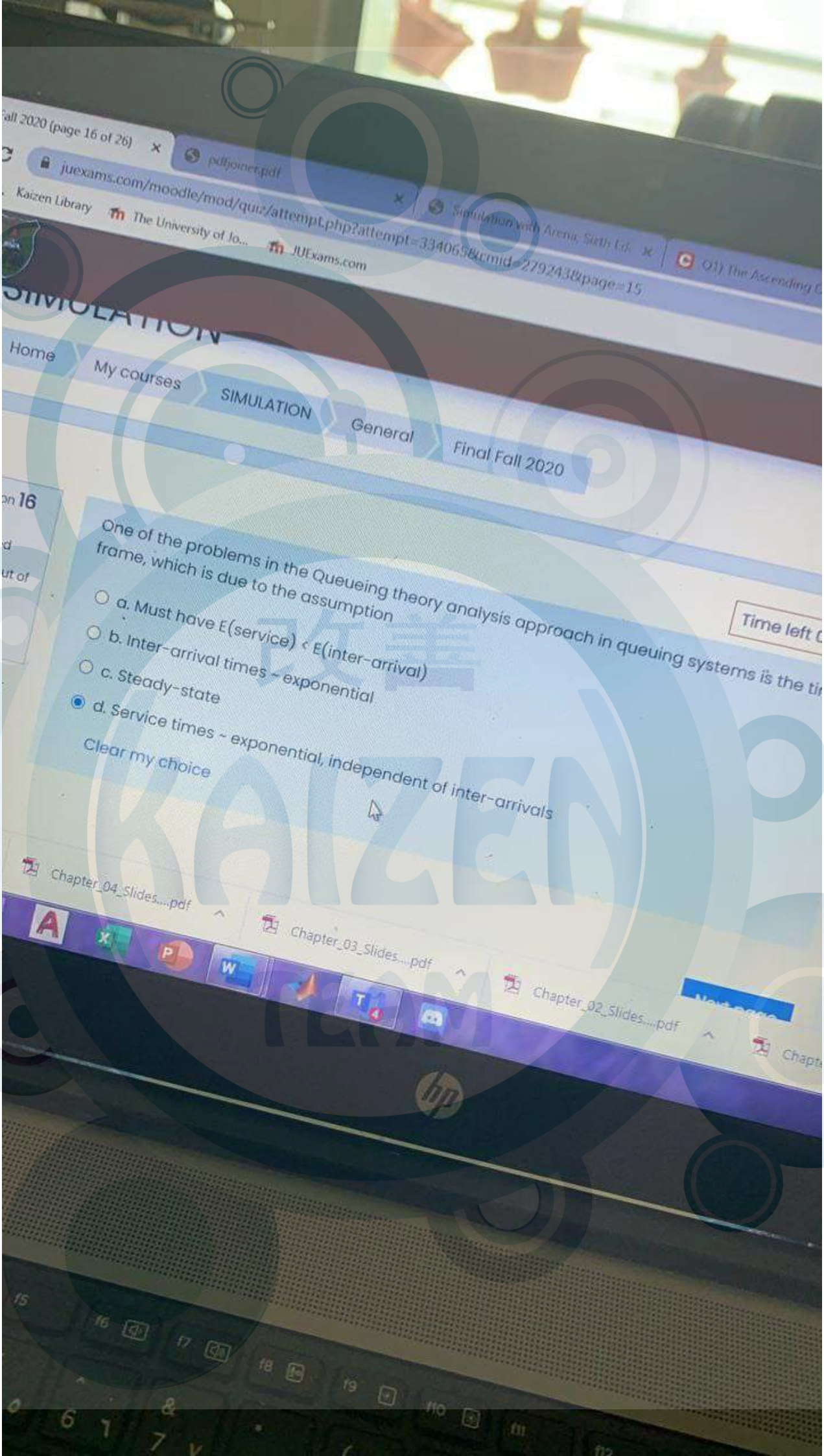
TEAM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Time left
One of the problems in the Queueing theory analysis approach in queuing systems is the ti
frame, which is due to the assumption
a. Must have E(service) < E(inter-arrival)
b. Inter-arrival times ~ exponential
c. Steady-state
d. Service times ~ exponential, independent of inter-arrivals
Clear my choice
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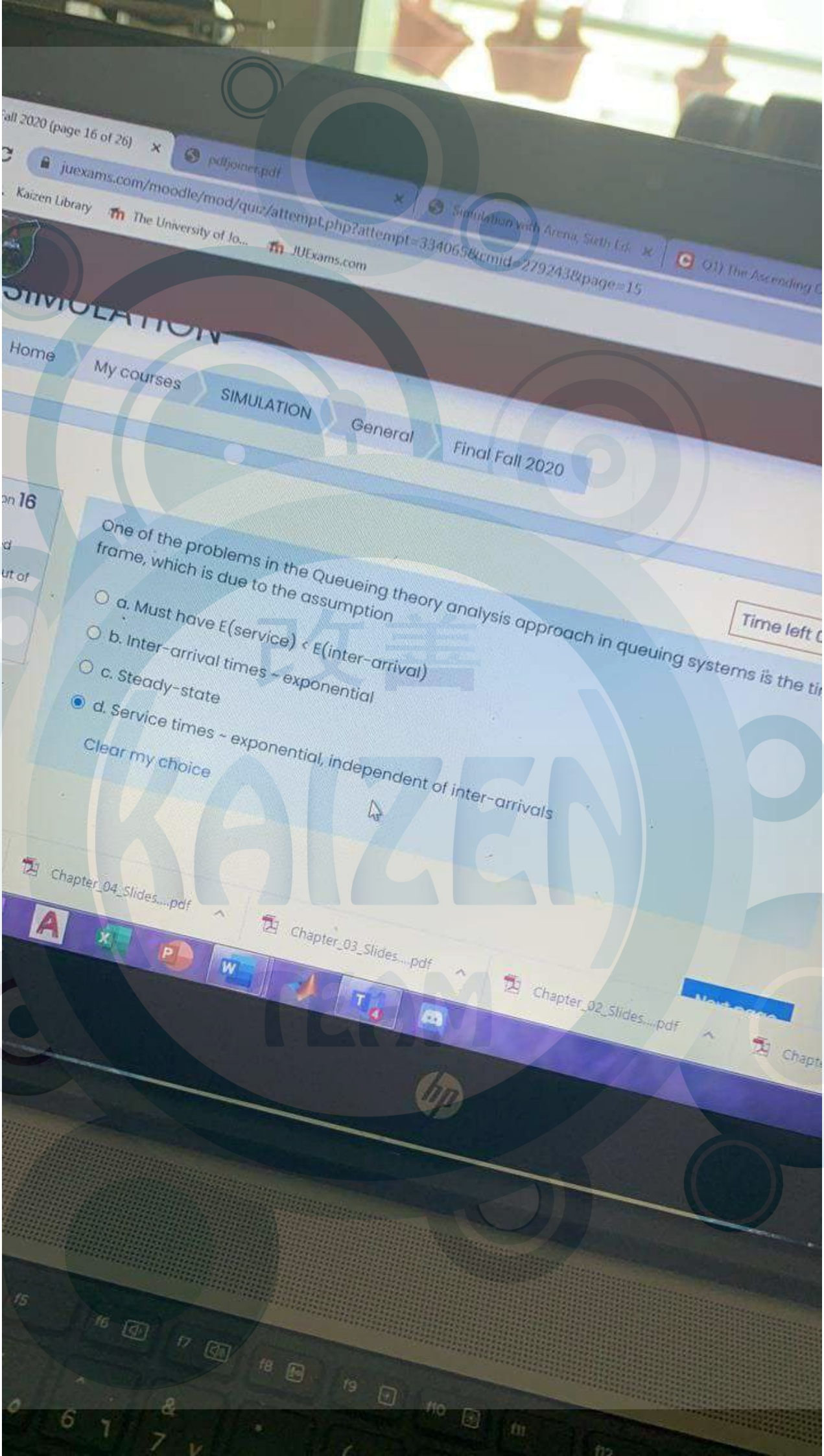
Chapter_03_Slides....pdf
Chapter_02_Slides....pdf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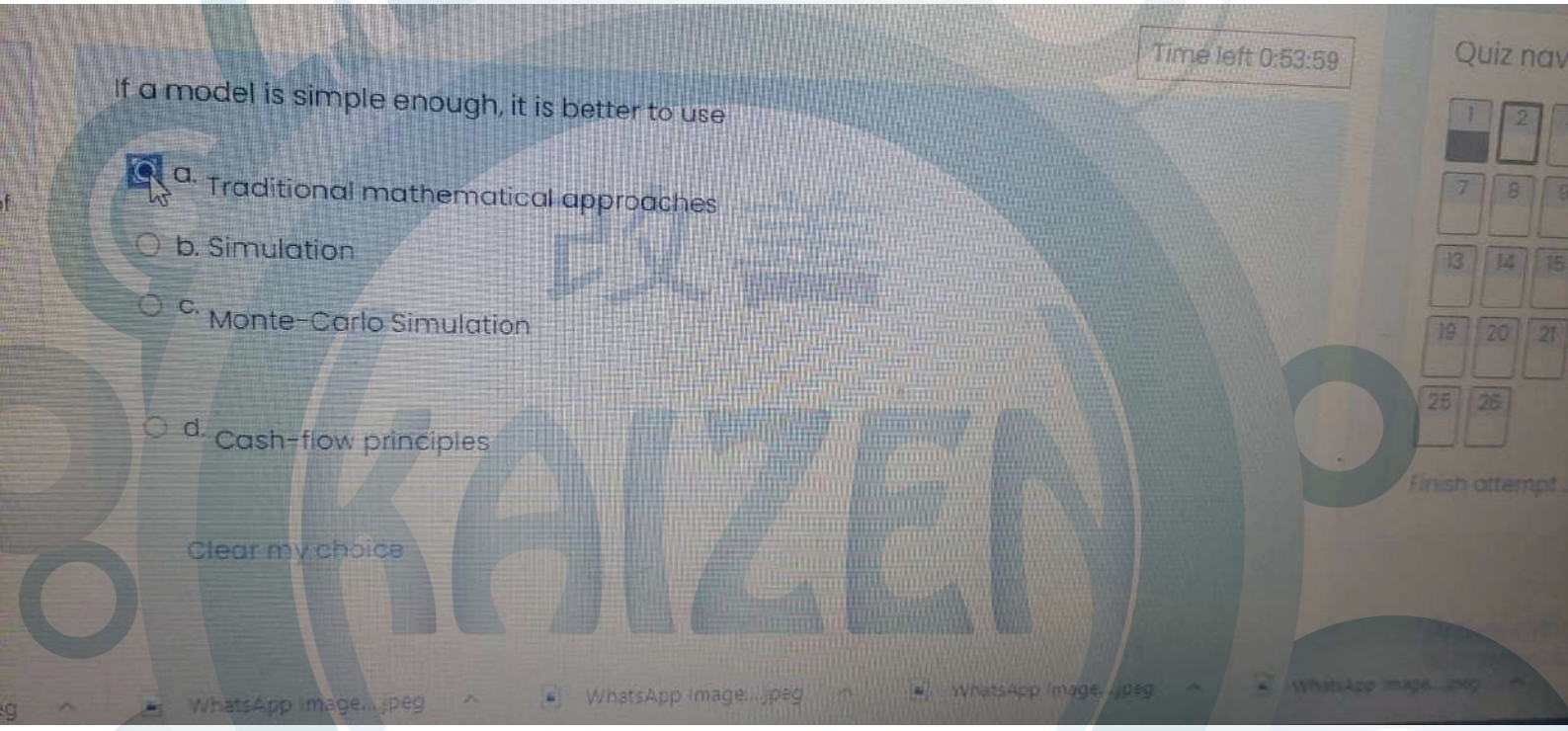
Clear my choice
Chapter_04_Slides....pdf
Chapter_03_Slides....pdf
Chapter_02_Slides....pdf


Time left 0:53:59
Quiz nav
If a model is simple enough, it is better to use
a. Traditional mathematical approaches
b. Simulation
c. Monte-Carlo Simulation
d. Cash-flow principles
Clear my choice
Finish attempt
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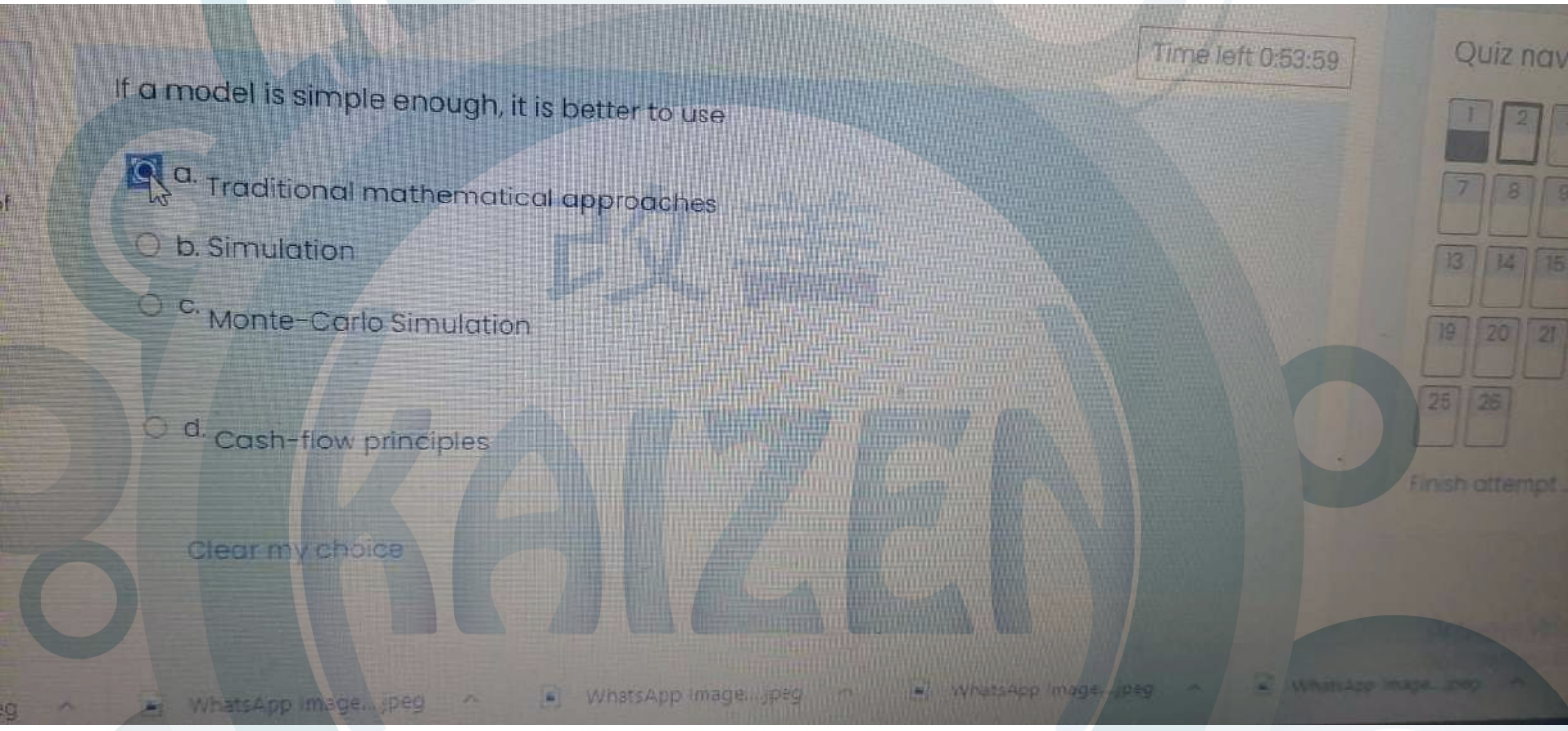
WhatsApp image...jpeg
WhatsApp image...jpeg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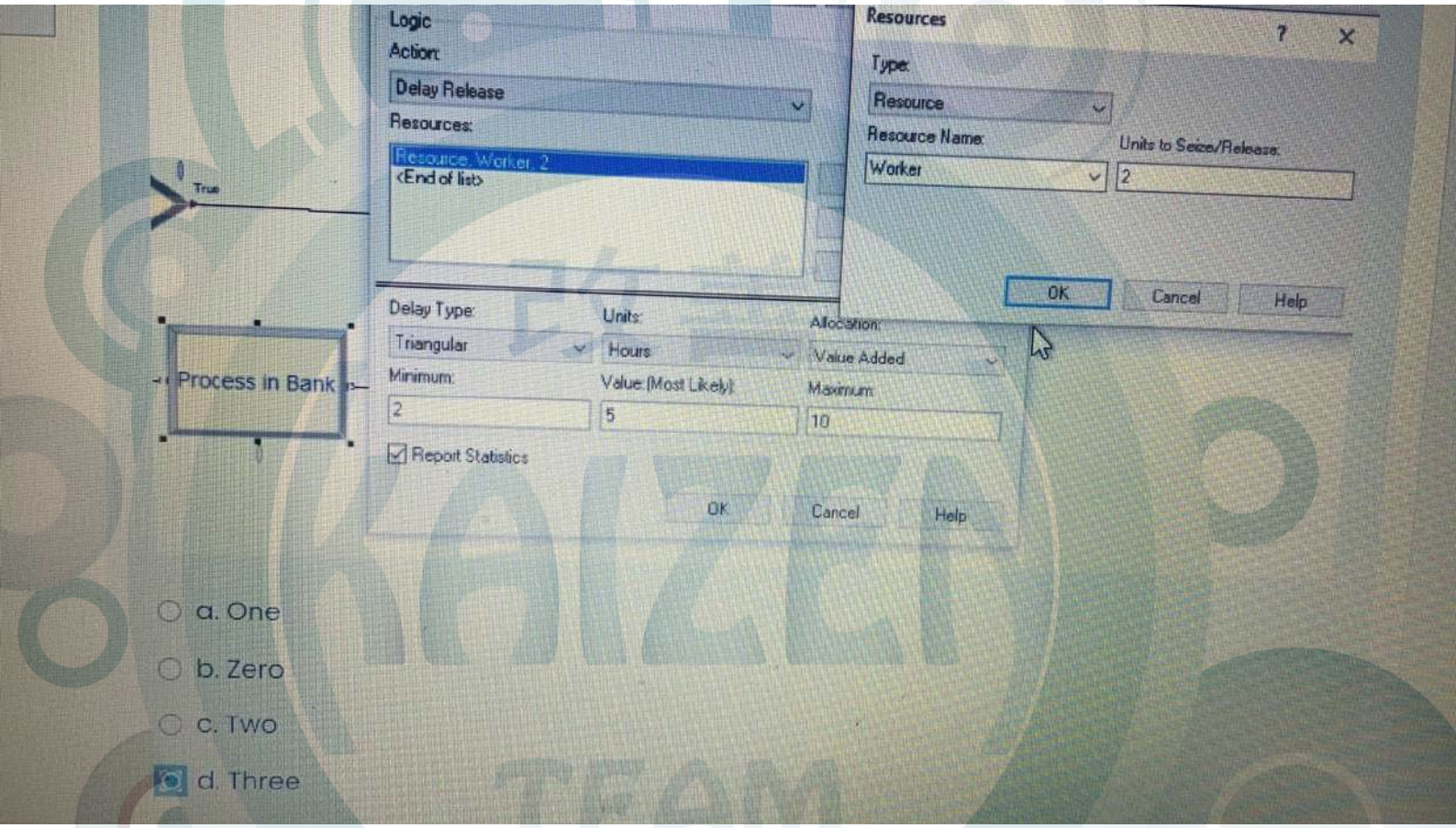
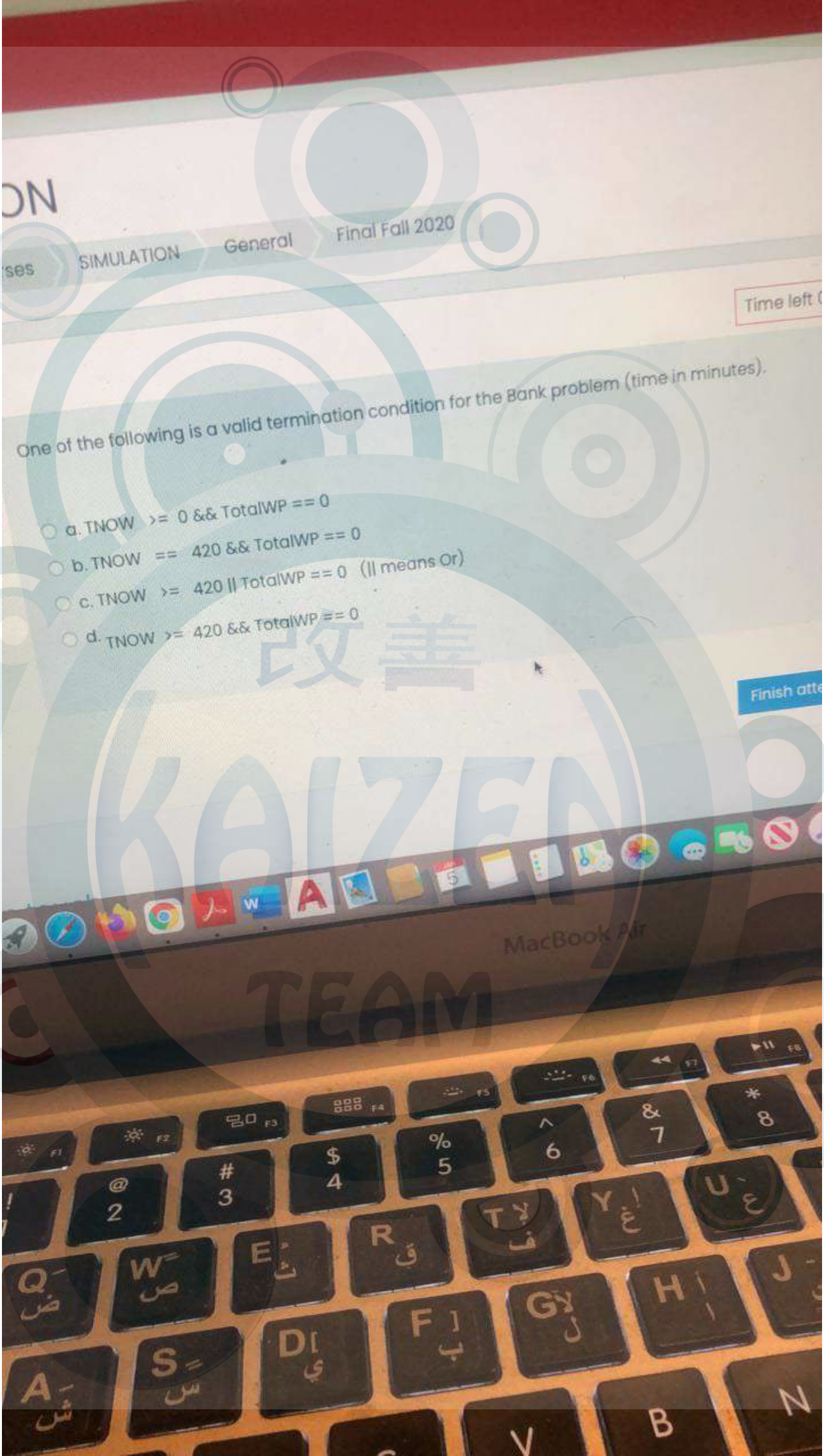


a. One

b. Zero

c. Two

d. Three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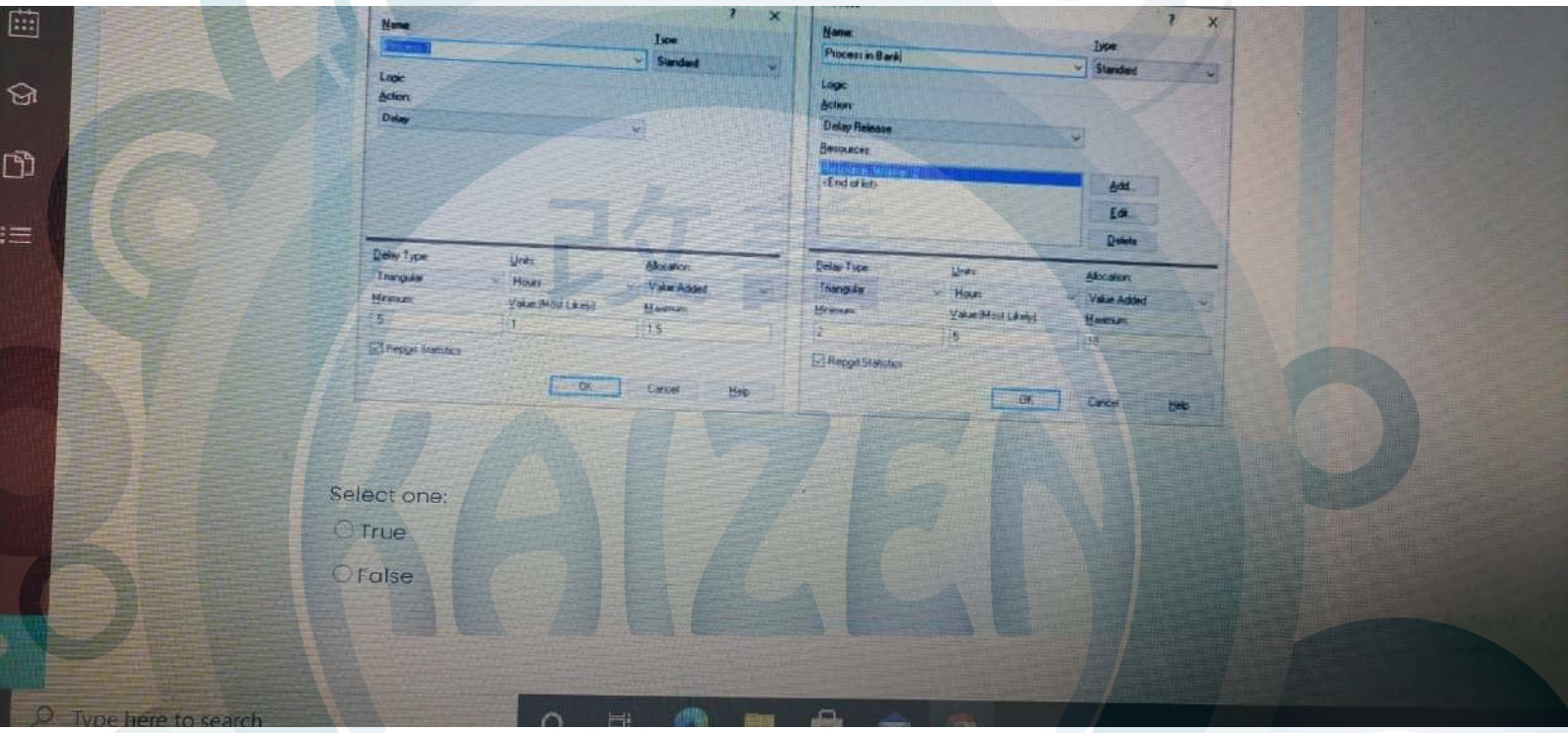
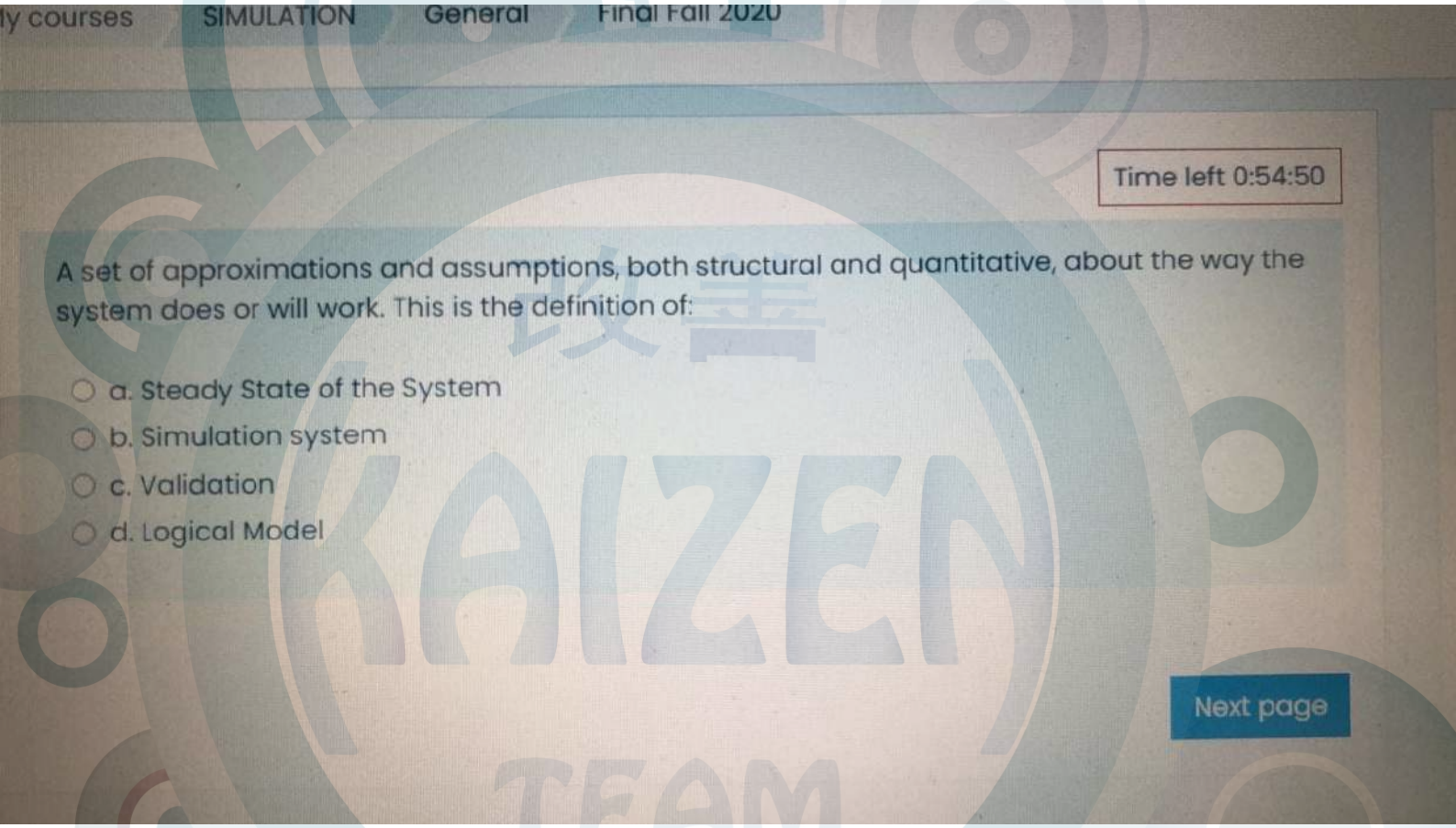
ses
SIMULATION
General
Final Fall 2020
Time left
One of the following is a valid termination condition for the Bank problem (time in minutes).
a. TNOW >= 0 && TotalWP == 0
b. TNOW == 420 && TotalWP == 0
c. TNOW >= 420 || TotalWP == 0 (|| means Or)
d. TNOW >= 420 && TotalWP == 0
Finish atte
MacBook Air

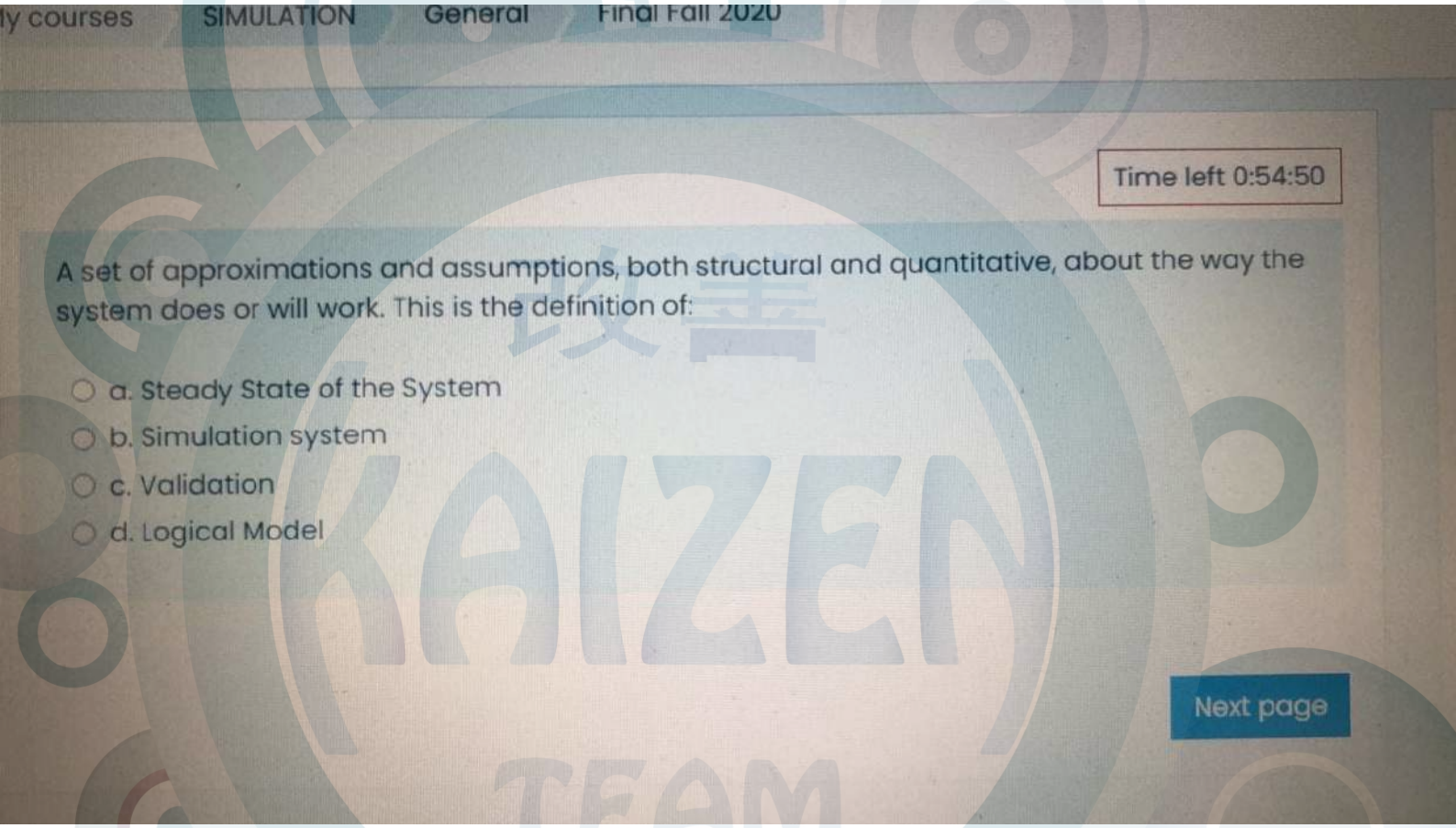


Select one:

- True
- False

Type here to search


y courses
SIMULATION
General
Final Fall 2020
Time left 0:54:50
A set of approximations and assumptions, both structural and quantitative, about the way the system does or will work. This is the definition of:
a. Steady State of the System
b. Simulation system
c. Validation
d. Logical Model
Next page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