+1/1/60+

Computing Infrastructures

Course 095897

P. Cremonesi, M.Roveri

2020-02-17

Student ID (codice persona):	Last Name / Cognome:
.....	.....
	First Name / Nome:
	.....

Answers must be given exclusively on the answer sheet (last sheet): DO NOT FILL ANY BOX IN THIS SHEET

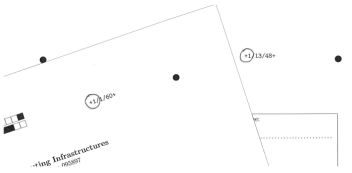
Students must use pen (black or blue) to mark answers (no pencil).
Students are permitted to use a non-programmable calculator.

Students are NOT permitted to copy anyone else's answers, pass notes amongst themselves, or engage in other forms of misconduct at any time during the exam.

Students are NOT permitted to use mobile phones and similar connected devices.

Scores: correct answers +1.5 point, unanswered questions 0 points, wrong answers -0.5 points.

Questions with multiple answers will be considered as not answered (0 points).



Check that the first number in the text and in the answer sheet is the same

A **Question 9:** ☐A ☐B ■C ☐D
Question 10: ☐A ☐B ■C ☐D
Question 11: ■A ☐B ☐C ☐D

If you make a mistake:

1. circle the word "Question"
2. write the correct answer to its side

Question 1: ■A ☐B ☐C ☐D
Question 2: ☐A ☐B ■C ☐D
Question 3: ☐A ■B ☐C ☐D
Question 4: ☐A ☐B ☐C ■D

Do not use crosses to mark the answers!
Completely fill the box!

Answer sheet: 104238 12

Student ID (codice persona):

☐0	■0	☐0	☐0	☐0	☐0	☐0	☐0
■1	☐1	☐1	☐1	☐1	☐1	■1	☐1
☐2	☐2	☐2	■2	☐2	☐2	☐2	☐2
☐3	☐3	☐3	☐3	■3	☐3	☐3	☐3
☐4	☐4	■4	☐4	☐4	☐4	☐4	☐4
☐5	☐5	☐5	☐5	☐5	☐5	☐5	☐5
☐6	☐6	☐6	☐6	☐6	☐6	☐6	☐6
☐7	☐7	☐7	☐7	☐7	☐7	☐7	■7
☐8	☐8	☐8	☐8	☐8	■8	☐8	☐8
☐9	☐9	☐9	☐9	☐9	☐9	☐9	☐9

Enter the numbers of your "Student ID" from left to right

Question 12
Consider a closed system with the following data: average number of users: 24 ($N = 24$) average response time: 31 sec ($R = 31$), average throughput: 0.41 trans/sec ($X = 0.41$), average CPU service demand: 0.60 sec/trans ($D_{\mathrm{CPU}} = 0.60$). Which is the average think time Z of a user?

A 40.00 sec ■ 27.54 sec C 58.54 sec D 9.00 sec

Explanation:
Z = N/X - R

Question 13
By monitoring a single class iteractive system, we are able to measure the following data:

- Monitoring period: 80 seconds
- CPU service time: 0.39 seconds/operation
- CPU utilization: 0.51
- Disk throughput: 7 operations/second
- Disk visits: 18 operations/transaction
- Response time: 1.5 seconds/transaction
- Number of users: 21

Which is the average think time of these users?

A 54.00 sec ■ 52.50 sec C 1.50 sec D 78.50 sec

Explanation:
X = Xdisk / Vdisk = 0.388888888888888888
Z = N/X - R = 52.50

Question 14
Consider a closed system with the following data: average number of users: 19 ($N = 19$) average response time: 42 sec ($R = 42$), average throughput: 0.49 trans/sec ($X = 0.49$), average CPU service demand: 0.84 sec/trans ($D_{\mathrm{CPU}} = 0.84$). Which is the CPU utilization?

A 0.70 ■ 0.41 C 0.03 D 0.59

Explanation:
Ucpu = X*Dcpu

Question 15
By monitoring a single class iteractive system, we are able to measure the following data:

- Monitoring period: 4 minutes
- Disk utilization: 0.32
- CPU utilization: 0.58
- CPU demand: 0.36 seconds/transaction
- Number of I/O operations / transaction 10
- Response time: 18 seconds/transaction
- Number of users: 45

Which is the average think time of these users?

[A] 5.81 sec [B] 6.40 sec ■ 9.93 sec [D] 27.93 sec

Explanation:
Z = N/X - R
X = Ucpu / Dcpu

Question 16
Consider a single-class multi station system with two stations. We have the following information about the system:

- station 1 response time: 11 seconds
- station 2 response time: 1 seconds
- station 1 throughput: 3 transactions/second
- station 2 throughput: 6 transactions/second
- system throughput: 4 transactions/second

Which is the average response time of the system?

[A] 12.00 sec ■ 9.75 sec [C] 0.56 sec [D] 5.12 sec

Explanation:
V1 = X1 / X
V2 = X2 / X
R1 = r1 V1
R2 = r2 V2
R = R1 + R2

Question 17
Consider a closed queuing network with the following characteristics:

- service demand Dmax = 0.6 sec
- service demand Dtot = 2.2 sec
- think time Z = 3 sec
- number of users N = 3

Which is the asymptotic lower bound of response time?

■ 2.20 sec B 1.60 sec C 1.60 sec D 1.69 sec

Explanation:
$\max(D, ND_{max} - Z) = \max(2.2, 3 \times 0.6 - 3) = 2.20$

Question 18
Consider a closed queuing network with the following characteristics:

- service demand Dmax = 1.6 sec
- service demand Dtot = 8.1 sec
- think time Z = 2 sec
- number of users N = 5

Which is the asymptotic upper bound of throughput?

A 0.62 tran/sec ■ 0.50 tran/sec C 0.63 tran/sec D 3.13 tran/sec

Explanation:
$\min(\frac{N}{D+Z}, \frac{1}{D_{max}}) = \min(\frac{5}{8.1+2}, \frac{1}{1.6}) = 0.50$

Question 19
Consider a batch system with one CPU and two disks, for which the following measurements have been obtained:

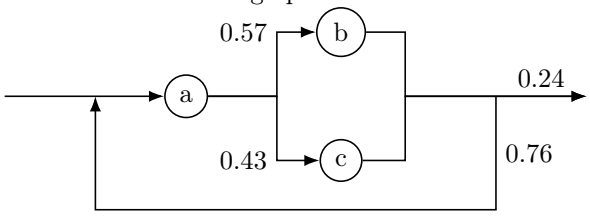
- Monitoring period: 250 seconds
- CPU busy time: 70 seconds
- Slow disk busy time: 52 seconds
- Fast disk busy time: 137 seconds
- Completed transactions: 100
- CPU completed operations: 100
- Slow disk completed operations: 100
- Fast disk completed operations: 500
- Number of concurrent jobs: 1

Using only the information available, shift files between disks in order to balance load between the two disks and increase the expected maximum throughput. Using asymptotic bounds, which is the maximum throughput for the **new, improved system** after you have moved the files? *Visits are not required to be integer number.*

A 1.03663 B 0.92879 ■ 0.35047 D 0.38610

Explanation:
$D_{slow} = B_{slow}/C = 0.52$ $D_{fast} = B_{fast}/C = 1.37$
$V_{fast} = C_{fast}/C = 5$ $V_{slow} = C_{slow}/C = 1$ $V_{bal} = V_{fast} + V_{slow} = 6$
$S_{fast} = D_{fast}/V_{fast} = 0.27400$ $S_{slow} = D_{slow}/V_{slow} = 0.52000$
$D_{cpu} = B_{cpu}/C = 0.7$ $D_{bal} = V_{bal}/(1/S_{slow} + 1/S_{fast}) = 1.07668$
$D_{totb} = 2 * D_{bal} + D_{cpu} = 2.85335$ $D_{maxb} = \max(D_{bal}, D_{cpu}) = 1.07668$
$X_{maxb} = \min(1/D_{maxb}, N/D_{totb}) = 0.35047$

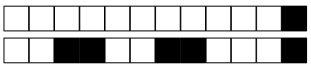
Question 21
Consider the following open network:



Which is the number of visits at station "b"?

A 1.57	B 0.57	■ 2.38	D 0.43

Explanation:
$V_1 = 1 + (1 - 0.24)(V_2 + V_3)$
$V_2 = 0.57V_1$
$V_3 = (1 - 0.57)V_1$
$V_1 = 1 + (1 - 0.24)(0.57V_1 + (1 - 0.57)V_1) = 1 + (1 - 0.24)(0.57V_1 + V_1 - 0.57V_1) = 1 + V_1 - 0.24V_1$
$V_1 = 1/0.24$
$V_2 = 0.57/0.24 = 2.38$



Question 22
Consider a single-class open queuing network with the following characteristics:

- Visits station A (Va): 1.9
- Visits station B (Vb): 2.0
- Service time station A (Sa): 0.23 sec/tran
- Service time station B (Sb): 0.20 sec/tran
- Arrival rate (λ): 1.64 tran/sec

Which is the system response time?

A 0.837 sec/tran
B 1.393 sec/tran
■ 2.705 sec/tran
D 4.437 sec/tran