CSE3201– Operating Systems
Midterm Exam, 2023
11:15 am – 12:45 pm [90 Minutes]
Computer Science and Engineering
University of Dhaka
Date: 2023/09/15

This exam contains 3 questions. Answer all 3 questions. **Total marks is 30.**

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1. (a) Suppose an operating system sends and receives data/information from input and output devices.
   i. (3 points) Suggest a design method for transferring bytes, megabytes, and send status of the sent previously.
   ii. (3 points) Recommend a method to improve the system's performance where speed differences between primary and secondary storage, processor registers, and main memory.

   (b) (3 points) We have discussed a lot of the advantages of microkernels. However, most major operating systems are monolithic kernels; why? Write three leading reasons.

   (c) (3 points) Thread increases the granularities of the OS to improve performance; however, in some instances, it reduces the performance. Explain? Hints: distribution of on-gram sweets among 40 people.

2. (a) (5 points) Write down the locations where the following variables or values are stored: (i) Initialized Global Variable, (ii) Constant or final variables, (iii) Process Stackframe, (iv) local variables, (v) Functions.

   (b) (2 points) Let kernel acquire an exception due to SVC; how can the OS determine the access level where the call originated?

3. (a) (6 points) Suggest the steps to adopt (i) system call and (ii) scheduling for mutitasking in DUOS on ARM32F4xxx system.

   (b) (2 points) Determine the process states for the following events: (i) An external interrupt occurs, (ii) The system raises Systick and then PendSV, (iii) User the process directly to access an invalid memory address, and (iv)Process prints a few characters to the UART terminal.

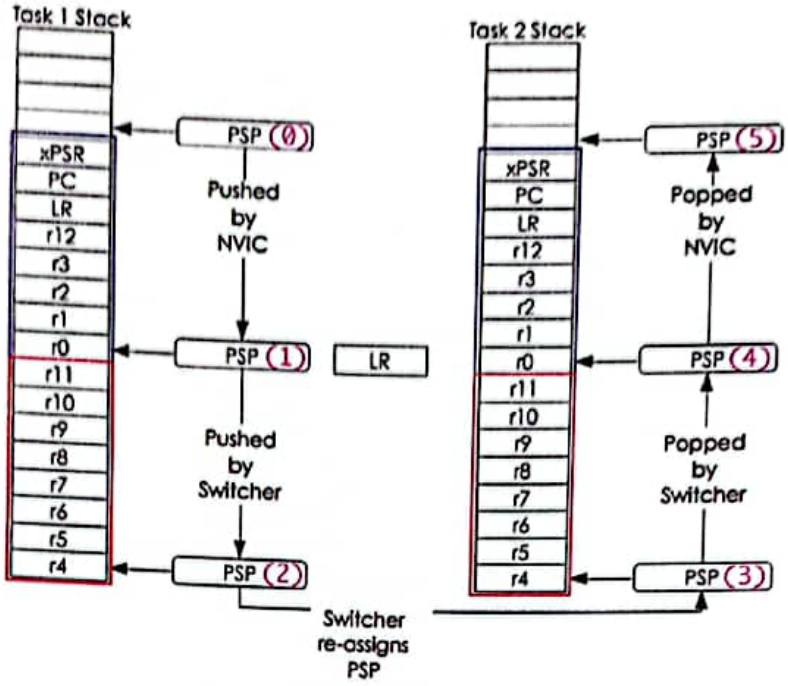


Figure 1: Figure Cotext Switch

(c) (3 points) Let us assume that a user-level process initiates a system call such as 'SVC #5'. Figure 1 shows the register push sequence (left). How a kernel programmer can determine the service number of the system call?

Incourse Examination

Third Year 2nd Semester, 2022

CSE 3203: Design and Analysis of Algorithms -II

Duration: 1 hour 30 minutes | Full marks: 40

1. Write down the Rabin-Karp algorithm by considering Σ= {all ASCII characters}. Apply this algorithm for text = *AABAACAADAABAABA* and pattern = *AABA*. 8

2. We call a pattern P nonoverlappable if $P_k \sqsupset P_q$ implies $k = 0$ or $k = q$. Give an example of a pattern of the above definition. Describe the state transition diagram of the string-matching automaton for a nonoverlappable pattern. 6

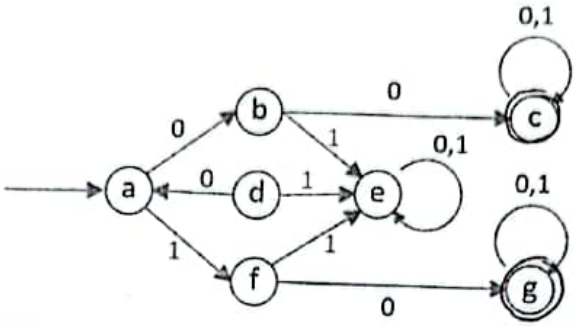
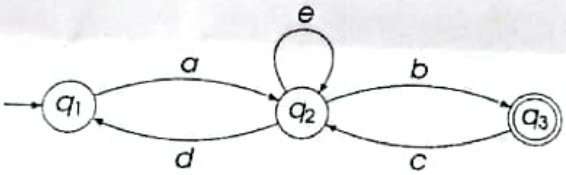
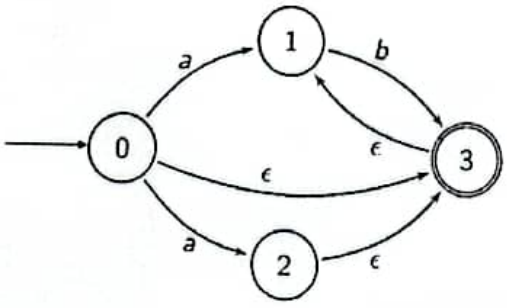
3. Write down a linear time algorithm to compute prefix function. Compute the prefix function for the pattern *ababbabbabbababbabb* using your given algorithm. Please show all the intermediate steps. 8

4. Prove that if NP ≠ co-NP, then P ≠ NP. 4

5. Prove that the clique problem is NP-complete. 6

6. Define approximation ratio. Give an approximation algorithm for the traveling salesperson problem. Prove that under certain constraints the approximation ratio is 2. 8

Midterm Exam – 2023
CSE 3204: Formal Language, Automata and Computability
Time: 1.5 Hours. Marks: 30

1.	Design a CFG for the following language: $L = \{a^i b^j \mid i \leq 2j\}$	4
2.	Find the minimum state DFA for the following automata. Show step by step elimination of states. 	5
3.	Write a regular expression (RE) whose language is the same as the language of the following DFA. Define the methodology you are going to apply to find the RE and show step-by-step application of the methodology on the DFA. 	5
4.	Using pumping lemma prove that the following language is not regular. $L = \{va^{2k} \mid v \in \{a,b\}^*, \lvert v\rvert = k\}$	5
5.	Find equivalent DFA for the following epsilon-NFA. First define the methodology you are going to apply to find the DFA and show step-by-step application of the methodology on the epsilon-NFA. Introduce dead states if necessary. 	7
6.	For the following CFG G, give transition diagram of a PDA P such that $L(G) = L(P)$ $S \rightarrow AS \mid \varepsilon$ $A \rightarrow aa \mid ab \mid ba \mid bb$	4

University of Dhaka
Department of Computer Science and Engineering
In-Course Examination
3rd Year 2nd Semester, Session: 2021-2022
STAT – 3205, Introduction to Probability and Statistics

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Total Marks: 25 Time: 1 Hour 30 Minutes

(Answer All of the following Questions)

1. a) The mean and variance of a sample of n = 25 measurements are 75 and 100, respectively. Use Tchebysheff's Theorem to describe the distribution of measurements. 2

b) Use the relationships of Mutually Exclusive and Independent Events to fill in the blanks in the table below: 2

$P(A)$	$P(B)$	Conditions for Events A and B	$P(A \cap B)$	$P(A \cup B)$	$P(A\|B)$
.3	.4	Mutually exclusive			
.3	.4	Independent			
.1	.5			.6	
.2	.5		.10		

2. a) Consider the following incourse numbers of 59 students of 3rd year Statistics course:

7 9 10 13 14 14 17 17 18 18
19 20 22 22 22 22 22 22 23 23
23 23 24 24 24 24 25 25 25 25
26 26 26 26 27 27 27 27 28 28
28 29 29 29 29 30 31 31 31 31
31 32 33 33 33 33 34 37 37

i) Find mean and mode with modality for the above data. 2
ii) Find the five number summary and the IQR. 2
iii) Draw the box plot for the above data. 2
iv) Are there any outliers? 1
v) Using mean and median, decide whether or not the data are symmetric or skewed. 1

3. a) 2 green, 4 red and 3 blue M&Ms are in a box. Three of them are selected at random. 3

i) Consider the three events: A: 1st is red, B: 2nd is green and C: 3rd is blue. Now find $P(A \cap B \cap C)$

ii) Find the probability that at least 2 of those are red or at most 1 of those is green.

b) If event A and B are independent, show that $P(\bar{A} \cap B) = P(\bar{A}).P(B)$ 2

c) Suppose that, in a particular city, airport A handles 50% of all airline traffic, and airports B and C handle 30% and 20%, respectively. The detection rates for weapons at the three airports are .9, .8, and .85, respectively. If a passenger at one of the airports is found to be carrying a weapon through the boarding gate, what is the probability that the passenger is using airport A? Airport C? 2

4. a) Let x equal the sum of the numbers observed on the throw of two balanced dies. 3
i) Find and graph the probability distribution for x.
ii) What is the average or expected value of x?
iii) What will be the shape of the distribution?

b) Accident records collected by an automobile insurance company give the following information: The probability that an insured driver has an automobile accident is .15; if an accident has occurred, the damage to the vehicle amounts to 20% of its market value with probability .80, 60% of its market value with probability .12, and a total loss with probability .08. What premium should the company charge on a $22,000 car so that the expected gain by the company is zero? 3