CSE3201– Operating Systems
Midterm Exam, 2022
Computer Science and Engineering
University of Dhaka
One hour and 30 min ($1\frac{1}{2}$ Hours)

This exam contains 2 pages and 5 Questions. **Total of points is 30.**

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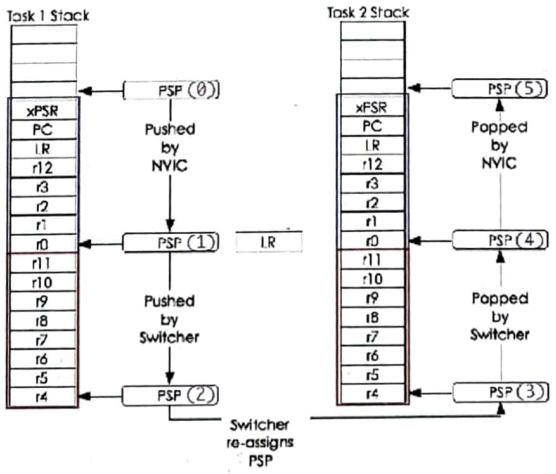
1. (10 points) The DUOS has three task: $task_1$, $task_2$, $task_3$, for executing, starting from address

   - $task_1$: 0x80002000
   - $task_2$: 0x80004000 and
   - $task_3$: 0x80005000

   Each task has 200 ARMv7 instructions and takes 1 microsecond to run an instruction. Size of the stack of each task is 1kB and starting address (downward)

   - $task_1$ stack: 0x200FFFFF to 0x200FFC00
   - $task_2$ stack: 0x200F2FFF to 0x200F2C00 and
   - $task_3$ stack: 0x200F1FFF to 0x200F1C00

   From the following figure determines the task's value of PSP and PC, (i) just after initializing the tasks and (ii) at 38 microsecond. Assume FPU is disabled. Also, note that PendSV takes 1 microsecond for context switching, and SysTick is configured to generate exceptions for scheduling after 10 microseconds, including time for context switching. Each time of execution $task_1$, $task_2$ and $task_3$ create array of 4, 5 and 6 elements (32-bit each elements). You do not need to calculate the exact value; approximate values are okay. However, it would be best if you put your reasoning behind it.



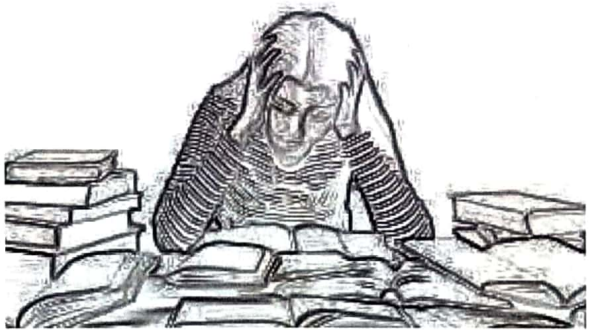
2. (5 points) Let us consider that switching time from unprivileged to privileged mode takes five milli-seconds, and switching from one thread to another takes two milliseconds. In this scenario, compare the application and kernel level thread implementation.

3. (5 points) Suppose DUOS processes (or threads) have three states (i) ready, (ii) waiting, (iii) running, and (iv) terminated. Determine the state of the process for the following scenarios.

- Process 1 evaluate an equation $y = \frac{2x^2+3x^3+4x+5}{z}$ where $z = 0$
- Process 2 call kprintf("Hello third year student %d",3+2);.
- Process 3 interrupted
- Process 4 creates a new 'process 5'.
- Process 5 exited

4. (5 points) An ECC memory has $20ns$ access time, and to read a word from the processor's internal cache memory is 5ns. Consider a process with 20kB of code, where 60% currently resides in the cache memory. (i) Determine the effective-access time by observing the execution of the process from the beginning to the end. (ii) Write exactly two sentences the effect of using cache memory.

5. (5 points) What are the contents of the interrupt vector table? Let us assume a program is running in user mode, and the system raises a USART interrupt. Specify the steps a microprocessor takes in clear sentences when the BASEPRI register value is 5.



University of Dhaka

3rd Year 2nd Semester B.Sc. (Hons.) Mid Term Examination 2021

Subject: Computer Science and Engineering

CSE-3202 Numerical Analysis

Time: 1:30 Hr. Full Marks: 25

1. Find the Taylor expansion of e^x about $x_0 = 0.5$ which use the first two, three, four and five and evaluate for $x = 1.0$, respectively. Find truncation errors $O(h^3)$ and $O(h^5)$ assuming calculator value of e^x as true value. 5

2. Let $f(x) = \sqrt{x}$, construct the third-degree interpolating polynomial, $P_3(x)$, for $f(x)$ using the points $x_0 = 1$, $x_1 = 2.25$, $x_2 = 3.2$ and $x_3 = 4$ for both Lagrange and divided difference interpolation. 5

3. A system of three variables is given below. Use Cramer's Rule to solve the system. 5

$$5x + y + 2z = 19$$

$$x + 4y - 2z = -2$$

$$2x + 3y + 8z = 39$$

4. Demonstrate Gauss-Siedel method upto 3 iterations for the following system of linear equations with initial guess [1, 1, 1, 1]: 5

$$2x_0 - 2x_1 + x_2 + 2x_3 = 2$$

$$4x_0 + 2x_1 - x_2 + x_3 = 1$$

$$3x_0 + x_1 + 3x_2 + 2x_3 = 1$$

$$x_0 + 3x_1 - 2x_2 - x_3 = -3$$

5

5. Given $x_0 = 2.5$, $x_1 = -1.0$, $x_2 = 3.2$ and $x_3 = 4$

(a) Make a 4×4 |A| and 4×1 |b| matrix

(b) Make L and U matrix from A using LU decomposition method

(c) Show that the values of are x like above.

University of Dhaka
Department of Computer Science and engineering
3rd Year 2nd Semester Incourse Examination 2021

Course Code: CSE-3203 Course Title: Design and Analysis of Algorithms-II

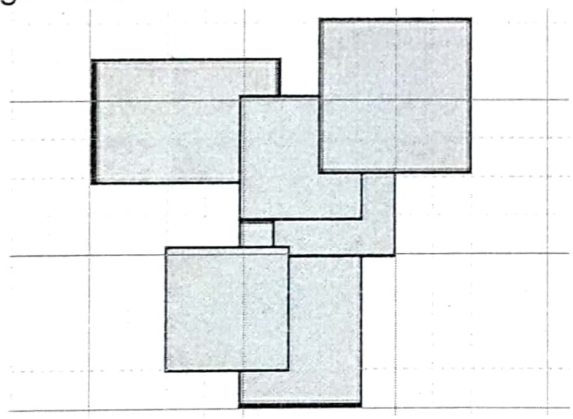
Time: One Hour Full Marks: 30

1) Suppose you have a 16-bit computing environment. Insert the following numbers in a hash table having 8 slots using the multiplication method. [10]

243, 1222, 23456, 11, 21

Note: You must show all calculations involved in finding the hash table slot for each number. Your calculation must not involve any floating-point arithmetic. Collision resolving will be done using the chaining method.

2) Suppose, you are provided with a set of axis-aligned rectangles of the form [(x1, y1), (x2, y2)] where (x1,y1) is top-left point and (x2,y2) is the bottom right point. Describe an idea along with pseudo-code to calculate the total area covered by all of these rectangles combined utilizing/applying the concept of *sweep-line* algorithm. [10]



3) Perform the following modular arithmetic operations. Show all the steps involved. [2.5+ 2.5+ 05]

i. $19 +_7 -11$
ii. $10 \cdot_{12} -33$
iii. $23 \div_{26} 7$

Midterm Exam – 2022

Theory of Computation

Time: 1.5 Hours. Marks: 40

<table>
<tr><td>1.</td><td>Prove that $1^2 + 2^2 + \cdots + n^2 = \frac{1}{6}n(n+1)(2n+1)$</td><td>5</td></tr>
<tr><td>2.</td><td>Prove that if T is a full binary tree with n vertices and height h, then $n \leq 2^{h+1} - 1$</td><td>5</td></tr>
<tr><td>3.</td><td>Prove that the language $L = \{a^{2k}w | k > 0, w \in \{a,b\}^*, |w| = k\}$ is not regular.</td><td>5</td></tr>
<tr><td>4.</td><td>Find the minimum state DFA for the RE $01 + 101^* + 011(0+1)^*$ following the steps below:
i. Find the NFA/ϵ-NFA for the RE
ii. Find equivalent DFA of the FA obtained at step i.
iii. Minimize the DFA obtained at step ii.</td><td>3 + 5 + 5</td></tr>
<tr><td>5.</td><td>i. Find the RE for the DFA whose state transition table is given below: (show step by step)

<table>
<tr><th>State</th><th>0</th><th>1</th></tr>
<tr><td>→A</td><td>B</td><td>C</td></tr>
<tr><td>B</td><td>D</td><td>E</td></tr>
<tr><td>C</td><td>F</td><td>G</td></tr>
<tr><td>*D</td><td>D</td><td>E</td></tr>
<tr><td>E</td><td>F</td><td>G</td></tr>
<tr><td>*F</td><td>D</td><td>E</td></tr>
<tr><td>*G</td><td>F</td><td>G</td></tr>
</table>
</td><td>12</td></tr>
</table>

University of Dhaka

Department of Computer Science and Engineering

3rd Year 2nd Semester In-course Examination, 2022

CSE – 3205, Introduction to Probability and Statistics

Total Marks: 25 Time: 1 Hour and 30 minute

1 A sample consists of the following data, which specifies the number of items purchased by 30 customers during the evening hours in a local supermarket. 6

15	8	6	9	9	4	18	10	10	12
12	4	7	8	12	10	11	11	9	13
5	6	11	14	5	6	6	5	13	5

a) Construct a frequency distribution by taking a suitable class interval.
b) Refer to part (b), draw a histogram.
c) Describe on the shape of the distribution.

2 The table shows data on the number of visitors to the UK in a month (v) and the amount of money they spent (m) in millions, for each of 8 months. 6

Number of visitors (v)	2450	2480	2540	2420	2350	2290	2400	2460
Amount of money they spent (m)	1370	1350	1400	1330	1270	1210	1330	1350

a) Calculate r, the correlation coefficient between the two variables, m and v.
b) Interpret the value of r in defining the direction and strength of the linear relationship between m and v.
c) Find the equation of the regression line of m and v.

3 'Mutually exclusive events must be dependent. Explain the statement. 4

4 A survey of people in a given region showed that 16% were smokers. The probability of death due to lung cancer, given that a person smoked was roughly 21 times the probability of death due to lung cancer, given that a person did not smoke. If the probability of death due to lung cancer in the region is .009, 3

a) What is the probability of death due to lung cancer, given that a person is a smoker? Are these two events independent? Explain.
b) What is the probability of death due to lung cancer, given that a person is not a smoker?

5 How much sleep do you get on a typical weekday? A group of 10 employees were asked to report the number of hours that they slept on the previous night with the following results: 6

7	6	7.5	7.25	8.5	5.5	8	7	6.75	6.5

a) Find the mean and the standard deviation(s) of the number of hours of sleep for these 10 employees.
b) Guess the value for s using the range approximation.
c) Calculate the z-score for the smallest value.
d) Construct a box plot for the data and find out the outliers, if any.