University of Dhaka
Department of Computer Science and Engineering
3rd Year 1st Semester Incourse Examination, 2023
CSE-3105: Multivariable Calculus and Geometry

Total Marks: 100 **Time: 1.5 Hour**

Q1. Determine whether the points lie on a straight line or not. [10]

(i) $< 5, -3, -6 >$ (ii) $< 7, -3, 4 >$ (iii) $< 1, 0, 5 >$

Q2. Consider the vectors, (i) $< 2, 2, -1 >$ (ii) $< 5, -3, 2 >$

Find a unit vector u such that u is perpendicular to both the vectors [10]

Q3. Find the scalar projection and vector projection of $< 2, 2, 1 >$ onto $< 1, 1, 1 >$ [10]

Q4. Find $\lim_{t \to 0} r(t)$, where $r(t) =< (1 + t^2 - 3t^3),\ te^{-t},\ \frac{sin(t)}{t} >$ [10]

Q5. Two aircrafts travel along the space curves considering the following parametric equations.

- ☐ Aircraft 1: $P_1(t) = < t,\ 1 + t^2,\ t^3 >$
- ☐ Aircraft 2: $P_2(t) = < 2t - 1,\ 3t^3,\ t^2 + 14 >$

The aviation company has a computing system to determine whether these two traveling paths are conflicting or not. Now,

- Find whether the aircrafts will collide or not. [10]
- Find the space point where their paths intersect, if exist. [10]

Q6. A wagon is pulled a distance of 100 m along a horizontal path by a constant force of 70 N. As a result, 6000J work is done by the force.

- Find the angle between the wagon handle with the horizon. [10]
- Explain how the amount of work done could be increased. [10]

Q7. Find the length of the arc of the circular helix with vector equation $\mathbf{r}(t) = cos(t)\,\mathbf{i} + sin(t)\,\mathbf{j} + t^2\,\mathbf{k}$ from the point (1, 0, 0) to the point $(1, 0, 2\pi)$. [10]

Q8. A batter hits a baseball 3m above the ground toward the center field fence, which is 10m high and 400m from home plate. The ball leaves the bat with a speed of 150m/s at an angle of 60° above the horizontal. Is it a home run? [In other words, does the ball clear the fence?] [Consider the gravity value as 10 m/s^2] [10]

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Answer all the questions. Marks are indicated at the left side bracket of each question.

Time: 75 Minutes | CSE 3101 - Computer Networking | Total Mark: 20

1. (a) (2 points) Define traffic intensity. "Propagation delay and Processing delay depends on the hardware of the router." Do you agree with this statement? Explain your answer.

   (b) (3 points) Briefly discuss how cookies can solve the lack of HTTP being a stateless protocol. Explain with the help of an interaction diagram between an HTTP client and a server.

2. (a) (2 points) Define the HOL blocking issue in HTTP/1.1 with the help of an example. Explain how HTTP/2 attempts to solve it.

   (b) (3 points) Given a UDP segment (at the right side) to be sent by a sender to a receiver. Investigate the value of the checksum of the payload of the segment. Show all the steps. Finally, calculate the value of the length field in decimal. Show all steps of calculation.

32 bits

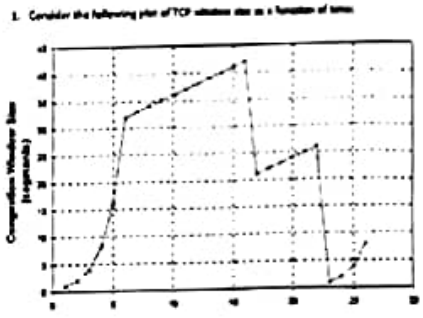
Source Port#	Destination Port#
Length =?	Checksum=?
0110011001100110	0000111100001111

UDP Segment

3. (a) (2 points) Suppose, Mr. X uses an email client (mail reader) to send an email to Mr. Y who uses a web-based email account (such as Hotmail or Gmail). The IP address of Mr. Y's mail server is initially unknown to Mr. X's mail server. List all the application layer protocols that might be used to transfer the messages when Mr. X sends the email to the time when Mr. Y reads it. Draw a diagram and clearly mention how these application-layer protocols are used when transferring the message.

   (b) (3 points) Consider a packet of length L that begins at router A and travels over three links to a destination router B. Suppose the packet is 1500 bytes. The propagation speed on all three links is 2.5×10^8 m/s and the transmission rates of all three links are 2.5 Mbps. The packet switch processing delay of all the routers is 3 msec. If the lengths of the first, second, and third links are 5000 km, 4000 km, and 1000 km respectively, analyze the scenario and calculate the end-to-end delay.

4. (a) (3 points)
   i) In the right side figure, identify the time intervals when TCP congestion avoidance is operating.
   ii) What are the values of cwnd and ssthresh at the time slot 24?
   iii) Let x represent the last digit of your class roll number multiplied by 30. During what time slot the x^{th} segment is sent?



   (b) (2 points) An ISP wants to generate a block of addresses starting with 171.81.0.0/16 and it wants to distribute these blocks to 1152 business customers as follows. The first group has 128 medium-sized businesses; each needs 128 addresses. The second group has 1024 small businesses; each needs 32 addresses. Design the subblocks by giving the network address and address range using slash notation, i.e., in the form of a.b.c.d/x for each subblock.

University of Dhaka
Department of Computer Science and Engineering
Incourse Examination
3rd Year 1st Semester, Session: 2022-2023
CSE – 3104, Database Management System II

Total Marks: 25 Time: 1 Hour 30 Minutes

(Answer All of the following Questions)

1. a) Considering reliability and performance of disks explain why we should use RAID. 3
   b) For a DBMS system which RAID level suits better? Explain your answer. 2
   c) Show the slotted page structure of variable length records for storing records within a block. 2

2. a) i) Create a B^+-tree with n = 4 using following numbers:
   25, 32, 27, 22, 8, 15, 46, 52, 82, 100 3
   ii) Delete 25 and then 100 from the created tree and show the modified trees. 2
   b) "B^+-tree is 'fat and short' but binary tree is 'thin and tall". You have been given 1 million search keys and you are using a B^+-tree with n = 5. Prove the statement considering height and width of the tree. 2
   c) Is B-tree better than B^+-tree as an index? Express your opinion. 3

3. a) Classify index. 1
   b) Write down the disadvantages of static hashing and also dynamic (extendable) hashing. 3
   c) Suppose you are a database designer. What file organization and indexing technique will you prefer and why? Explain your answer. 4

CSE 3102: Software Engineering

Marks: 30
Time: 75 minutes

Answer all the questions

Consider the following description of a system and based on the description answer the following questions

A token-ring based local-area-network (LAN) is a network consisting of nodes, in which network packets are sent around. Every node has a unique name within the network, and refers to its next node. Different kinds of nodes exist: workstations are originators of messages; servers and printers are network nodes that can receive messages. Packets contain an originator, a destination and content, and are sent around on a network. A LAN is a circular configuration of nodes.

1. Identify all the actors and give functional and non-functional requirements. **5**
2. Describe any two scenarios formally. **5**
3. Give use case diagram and mention to which use case(s) the aforementioned scenarios are related to. **10**
4. Identify and name all objects (entity, boundary and control) and give their aggregation. **5**
5. Give state chart for the 'Packet' object. **5**

CSE3103– Microprocessor and Microcontroller
Midterm Exam, Jan-June, 2024
Computer Science and Engineering
University of Dhaka
Exam Duration: 90 Minutes

March 13, 2024

This exam contains 4 questions. Answer any 3 (three) questions. **Total marks is 30.**

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1. (a) (5 points) Convert the following ARM assembly code into machine language. Write the instructions in hexadecimal.
   i. EORGTS R6, R3, #5
   ii. ADD R1, R2, R3, LSL #9

   (b) (5 points) Translate the following machine language to the ARM assembly code
   i. 0xE3821F21
   ii. 0xE1A04638

2. (a) (2 points) Assuming that the registers R1, R2, R3, R4 contain the values 0x11aa, 0x22bb, 0x33cc, 0x44dd respectively, and that the register R5 contains the value 0x1000, what is the value in R5 after each of the following ARM instructions in this program fragment and what byte value is stored in each affected memory location? (Assume a little-endian configuration.)
   STR R2, [R5, #4]
   STR R3, [R5], #4

   (b) (1 point) What are the three registers that are initialized on Reset in cortex M4?

   (c) (4 points) For each ARM instruction below, answer the following questions:
   i. What is the addressing mode of the instruction?
   ii. What is the effective address (EA) of the operand?
   iii. What will be change to the content of memory or registers after the instruction is executed?
   Note that, the instructions are executed individually. No dependency preserves among the instructions. You can assume the initial value of the registers
   i. LDR R3, [R4, #-4]!
   ii. ADD R5, R6, #13

   (d) (3 points) Write an assembly language to disable all the interrupts with priority 0x30.

3. Timer 'TIM6' is a basic timer that keeps counts of the clock plus feeds into it. Timer 'TIM6' is connected to the 'APB1' bus running with a 45MHz clock. 'TIM6_PSC' is a 16-bit prescaler register or divider to feed the desired clock to the timer. 'TIM6_ARR' and 'TIM6_CNT' are 16-bit registers dedicated to auto-reloading the timer's counting range and instantaneous count value. The timer generates an update interrupt for the count configuration whenever the 'TIM6_CNT' register value equals the counting range. (hints: other registers are given)

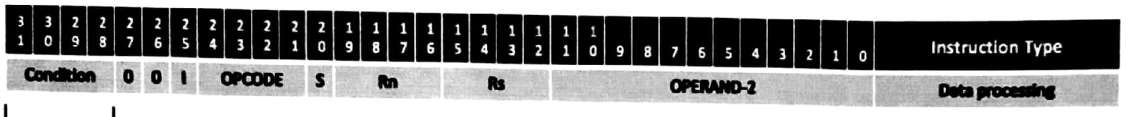
   (a) (2 points) Enable and configure the timer for upcounter that generate an update interrupt after every 1 (one) millisecond.

(b) (3 points) The 'TIM6_SR' (32-bit) shows the status of the timer, including update interrupt at bit position '0'. The update interrupts service routing is 'tim6_update_isr()', which updates a global variable (say uint64_t) to keep the millisecond count. Write down the update function.

(c) (3 points) Next, write down a delay function say 'ms_delay(uint32_t x)' to sleep or wait for 'x' milliseconds.

(d) (2 points) Now, write a program/function that can determine the number of millisecond to print hello world 10000 times.

4 UART4 connection to APB1 bus running in 22.5MHz using PC10 and PC11 for TX and RX. Configure the UART4 with BAUD rate 115200 with no 8 or 16 sampling. To do so determine the steps and write down the content of the UART4 and coresponding GPIO port. The alternate function for TX/RX GPIO is AF8. (hints: registers are given)



0000 = EQ - Z set (equal)
0001 = NE - Z clear (not equal)
0010 = HS / CS - C set (unsigned higher or same)
0011 = LO / CC - C clear (unsigned lower)
0100 = MI -N set (negative)
0101 = PL - N clear (positive or zero)
0110 = VS - V set (overflow)
0111 = VC - V clear (no overflow)
1000 = HI - C set and Z clear (unsigned higher)
1001 = LS - C clear or Z (set unsigned lower or same)
1010 = GE - N set and V set, or N clear and V clear (>or =)
1011 = LT - N set and V clear, or N clear and V set (>)
1100 = GT - Z clear, and either N set and V set, or N clear and V set (>)
1101 = LE - Z set, or N set and V clear,or N clear and V set (<, or =)
1110 = AL - always
1111 = NV - reserved.

Opcode	Instruction
0000	AND
0001	EOR
0010	SUB
0100	ADD
0101	ADC
0110	SBC
1010	CMP
1100	ORR
1101	MOV /Shift
1110	BIC

sh	Instruction
00	LSL
01	LSR
10	ASR
11	ROR

Table 1: Binary of the Opcodes

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
		DAC EN	PWR EN	CEC EN	CAN2 EN	CAN1 EN	FMPI2C1 EN	I2C3 EN	I2C2 EN	I2C1 EN	UART5 EN	UART4 EN	USART3 EN	USART2 EN	SPDIFRX EN
		rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SPI3 EN	SPI2 EN			WWDG EN			TIM14 EN	TIM13 EN	TIM12 EN	TIM7 EN	TIM6 EN	TIM5 EN	TIM4 EN	TIM3 EN	TIM2 EN
rw	rw			rw			rw	rw	rw	rw	rw	rw	rw	rw	rw

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	OTGHS ULPIEN	OTGHS EN							DMA2 EN	DMA1 EN			BKP SRAMEN		
	rw	rw							rw	rw			rw		

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
			CRC EN					GPIOH EN	GPIOG EN	GPIOF EN	GPIOE EN	GPIOD EN	GPIOC EN	GPIOB EN	GPIOA EN
			rw					rw	rw	rw	rw	rw	rw	rw	rw

Figure 1: RCC_APB1ENR & RCC_AHB1ENR registers

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
								ARPE				OPM	URS	UDIS	CEN
								rw				rw	rw	rw	rw

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
							UDE								UIE
							rw								rw

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
															UIF
															rc_w0

Figure 2: Timer registers: CR1, DIER, SR,

Table 164. USART register map and reset values

Offset	Register	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0x00	USART_SR																							CTS	LBD	TXE	TC	RXNE	IDLE	ORE	NF	FE	PE
	Reset value																							0	0	1	1	0	0	0	0	0	0
0x04	USART_DR																							DR[8:0]									
	Reset value																							0	0	0	0	0	0	0	0	0	0
0x08	USART_BRR																	DIV_Mantissa[15:4]												DIV_Fraction [3:0]			
	Reset value																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x0C	USART_CR1																	OVER8		UE	M	WAKE	PCE	PS	PEIE	TXEIE	TCIE	RXNEIE	IDLEIE	TE	RE	RWU	SBK
	Reset value																	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 26. GPIO register map and reset values

Offset	Register	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0x00	GPIOA_ MODER	MODER15[1:0]		MODER14[1:0]		MODER13[1:0]		MODER12[1:0]		MODER11[1:0]		MODER10[1:0]		MODER9[1:0]		MODER8[1:0]		MODER7[1:0]		MODER6[1:0]		MODER5[1:0]		MODER4[1:0]		MODER3[1:0]		MODER2[1:0]		MODER1[1:0]		MODER0[1:0]	
	Reset value	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x00	GPIOB_ MODER	MODER15[1:0]		MODER14[1:0]		MODER13[1:0]		MODER12[1:0]		MODER11[1:0]		MODER10[1:0]		MODER9[1:0]		MODER8[1:0]		MODER7[1:0]		MODER6[1:0]		MODER5[1:0]		MODER4[1:0]		MODER3[1:0]		MODER2[1:0]		MODER1[1:0]		MODER0[1:0]	
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
0x00	GPIOx_MODER (where x = C..H)	MODER15[1:0]		MODER14[1:0]		MODER13[1:0]		MODER12[1:0]		MODER11[1:0]		MODER10[1:0]		MODER9[1:0]		MODER8[1:0]		MODER7[1:0]		MODER6[1:0]		MODER5[1:0]		MODER4[1:0]		MODER3[1:0]		MODER2[1:0]		MODER1[1:0]		MODER0[1:0]	
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x04	GPIOx_ OTYPER (where x = A..H)																	OT15	OT14	OT13	OT12	OT11	OT10	OT9	OT8	OT7	OT6	OT5	OT4	OT3	OT2	OT1	OT0
	Reset value																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x08	GPIOx_ OSPEEDER (where x = A..H except B)	OSPEEDR15[1:0]		OSPEEDR14[1:0]		OSPEEDR13[1:0]		OSPEEDR12[1:0]		OSPEEDR11[1:0]		OSPEEDR10[1:0]		OSPEEDR9[1:0]		OSPEEDR8[1:0]		OSPEEDR7[1:0]		OSPEEDR6[1:0]		OSPEEDR5[1:0]		OSPEEDR4[1:0]		OSPEEDR3[1:0]		OSPEEDR2[1:0]		OSPEEDR1[1:0]		OSPEEDR0[1:0]	
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x08	GPIOB_ OSPEEDER	OSPEEDR15[1:0]		OSPEEDR14[1:0]		OSPEEDR13[1:0]		OSPEEDR12[1:0]		OSPEEDR11[1:0]		OSPEEDR10[1:0]		OSPEEDR9[1:0]		OSPEEDR8[1:0]		OSPEEDR7[1:0]		OSPEEDR6[1:0]		OSPEEDR5[1:0]		OSPEEDR4[1:0]		OSPEEDR3[1:0]		OSPEEDR2[1:0]		OSPEEDR1[1:0]		OSPEEDR0[1:0]	
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
0x20	GPIOx_AFRL (where x = A..H)	AFRL7[3:0]				AFRL6[3:0]				AFRL5[3:0]				AFRL4[3:0]				AFRL3[3:0]				AFRL2[3:0]				AFRL1[3:0]				AFRL0[3:0]			
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0x24	GPIOx_AFRH (where x = A..H)	AFRH15[3:0]				AFRH14[3:0]				AFRH13[3:0]				AFRH12[3:0]				AFRH11[3:0]				AFRH10[3:0]				AFRH9[3:0]				AFRH8[3:0]			
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0