

3. In order to debug an FTP server (running at 192.168.1.101), a system admin opened a TCP connection to port 21 of the FTP server (see below): 4

```
sa@helix:~ $ nc 192.168.1.101 21
220 raspberrypi FTP server (Version 6.4/OpenBSD/Linux-ftpd-0.17)
ready.
user rspi
331 Password required for rspi.
pass T78(4)7u987
230 User rspi logged in.
list
425 Can't build data connection: Connection refused.
```

Give a possible cause of the error code 425.

- 4 Consider the TCP procedure for estimating RTT. Suppose that $\alpha = 0.1$. Let SampleRTT1 be the most recent sample RTT, let SampleRTT2 be the next most recent sample RTT, etc. For a given TCP connection, suppose 4 acknowledgements have been returned with corresponding sample RTTs SampleRTT4, SampleRTT3, SampleRTT2, and SampleRTT1. Express EstimatedRTT in terms of the four sample RTTs. 4

5. Assume a TCP server is listening on port 12000 of 192.168.1.1. The server simply sends back the string that it gets from the client. You have written a simple Python TCP client (which resides on the same network of that of the server) that sends random strings to the server. 4

```
from socket import *
from random import random
serverName = '192.168.1.1'
serverPort = 12000

clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName, serverPort))

while 1:
    msg = str(random()) #gets a random string
    clientSocket.send(msg.encode())

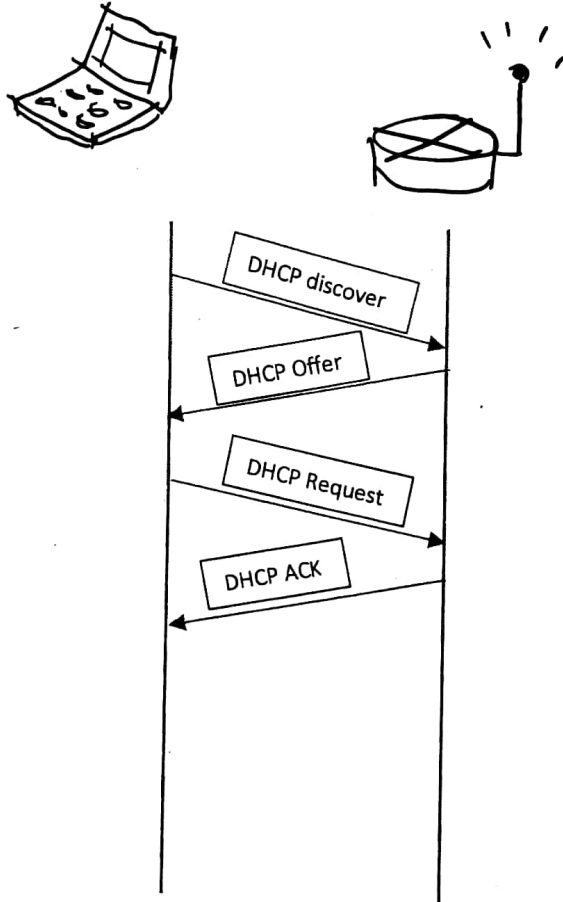
clientSocket.close()
```

After running the TCP client and observing the packets exchanged using Wireshark, you found that the TCP throughput dropped to zero after a while. Explain a possible reason behind this strange scenario.

- * 6 Suppose TCP uses AIMD for its congestion control without slow start. Assuming *cwnd* increases by 2 MSS every time a batch of ACKs is received and assuming approximately constant round-trip times, how long does it take for *cwnd* to increase from 4 MSS to 12 MSS (assuming no loss events)? 4

4

Suppose you have connected your laptop computer to department's WiFi network. Next execute your proxy client (that you developed in the 2nd Lab) in a terminal of your laptop in order to fetch the web page at www.amazon.com. Show the sequence of application layer and transport layer packets involved in this process. You can safely ignore flow control or any kind of packet loss/delay. For your convenience, first few packets are shown in the diagram below.



In course Term Examination, 2022
University of Dhaka
MATH: 3105 Multivariable Calculus and Geometry
Total: 30
Time: 1 Hour 15 Minutes

1. Show that $2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ is perpendicular to $5\mathbf{i} - 4\mathbf{j} + 2\mathbf{k}$. 3
2. In case of a vector space, what is the difference between the Standard basis and Nonstandard basis? 3
3. Find parametric equations and symmetric equations of the line that passes through the points A (2, 4, -3) and B (3, -1, 1). 5
4. Find the angle between the planes $x + y + z = 1$ and $x - 2y + 3z = 1$. Also find the Find symmetric equations for the line of intersection of these two planes. 7
5. Consider the linear transformation $T: R^n \rightarrow R^m$ represented by $T(\mathbf{x}) = A\mathbf{x}$. Find the nullity and rank of T , and determine whether T is one-to-one, onto, or neither. 6

a. $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

b. $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$

6. Find the null space of A, where 6

$$A = \begin{bmatrix} 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & -2 & 0 \\ 4 & 2 & 0 & 0 & 3 \\ 1 & 1 & 1 & -2 & 1 \\ 2 & 2 & 0 & 0 & 2 \\ 1 & 1 & 2 & -4 & 1 \end{bmatrix}$$

Answer all the questions

1. Justify the statement with proper reasoning "*The requirement analysis document serves as a contract between development team and the customer*". 5
2. Identify functional and non-functional requirements of the following system. 5

Suppose you want to develop software for an alarm clock. The clock shows the time of day. Using buttons, the user can set the hours and minutes fields individually, and choose between 12 and 24-hour display. It is possible to set one or two alarms. When an alarm fires, it will sound some noise. The user can turn it off, or choose to 'snooze'. If the user does not respond at all, the alarm will turn off itself after 2 minutes. 'Snoozing' means to turn off the sound, but the alarm will fire again after some minutes of delay. This 'snoozing time' is pre-adjustable.

3. Consider the following description of a *buy a product* system and identify the actors and mention one scenario. 5

Customer browses catalog, selects items to buy and then goes to check out. Customer fills in shipping information (address, receive time). System presents full pricing information and customer fills in credit card information. System authorizes purchase, confirms sale and sends confirming email to customer.

4. Consider the following description of a ~~buy a product~~ system and give a use case diagram to model this system. 10

A user can request a quiz for the system. The system picks a set of question from its database and composes them together to make a quiz. It rates the user's answers, and gives hints if the user requests it. In addition to users, we also have tutors who provide questions and hints. And also examiners who must certify questions to make sure they are not too trivial, and that they are sensible.

5. Write a UML state diagram of a cruise control system of a car. Use at least five states with specified transitions. 5

The system does not work under 50 km/h. If the throttle pedal is pressed while cruise control maintains a user selected speed, the car will accelerate. If the throttle pedal is released again, the cruise control system resumes maintaining the user selected speed. If the break pedal or transmission pedal is pressed the cruise control system is turned off. But it remembers the latest user selected speed, and uses that as default speed if the user turns the cruise control system on again. If the engine is turned off or the handbrake is engaged, the cruise control system is off and the latest user selected speed is forgotten. While the cruise control system is maintaining the speed of the car, the user can increase or decrease the user selected speed in steps of 1 km/h by clicking either of two buttons (+ and -).

30km

throttle pedal all



CSE 3103– Microprocessor and Microcontroller
MidTerm Exam, 2022
Computer Science and Engineering
University of Dhaka

Prof. Upama Kabir, PhD

Time = 45 Minutes

Total marks is 25

[Part A]

[Answer all the following questions]

1. (7 points) Multiple Choice Questions.

1. Processors that are typically used in mobile phone, mobile computing devices, television, and some of the energy efficient servers are
 - (a) Cortex-R processors
 - (b) Cortex-A processors
 - (c) Cortex-M processors
 - (d) ARM9E series
2. Which of the following statements with respect to k -segment pipelining are true?
 - (a) Minimum speedup that a pipeline can provide is k theoretically
 - (b) It is impossible to achieve maximum speedup k in k -segment pipeline
 - (c) All segments in pipeline take same time in computation
 - (d) None of the above
3. A peripheral with parallel data interface to control external devices and to read back external signals status is termed as
 - (a) GPIO
 - (b) RTC
 - (c) I2C
 - (d) ADC
4. How many bits are required to specify the Register operands in an Cortex M4 instruction?
 - (a) 32 bits
 - (b) 8 bits
 - (c) 16 bits
 - (d) 12 bits
5. If an instruction takes 3 cycles for execution, then how many cycles are needed for executing 4 instructions of the same type in a sequence using a 3-stage pipeline? Assume that there are no interrupts or exceptions while executing them.
 - (a) 12 cycles
 - (b) 9 cycles

- (c) 6 cycles
(d) 4 cycles
6. An instruction that is used to move data from an ARM Register to a Status Register (CPSR) is called
(a) MRC
(b) MRS
(c) MSR
(d) MCS
7. Status of Z flag after the execution of CMP instruction given below, when $R0 = 12$; $R9 = 12$; is *CMP* $R0, R9$
(a) $Z=1$
(b) $Z=0$
(c) Same as previous value
(d) None of the above
8. (1 point) Explain the difference between the instruction: *ADD* $R0, R0, R0$ and *ADDS* $R0, R0, R0$.
9. (2 points) Register $R1$ has the value $0x80008001$, what is its value after the following operations are performed independently:

Table 1:

Operation	R1
LSR $R1, R1, \#3$	
LSL $R1, R1, \#4$	

10. (2 points) Mention the purpose of the following Directives.

Table 2:

Directive	Purpose
AREA	
ALIGN	

5. (4 points) For the following set of instructions, mention the addressing mode type and calculate the effective address. Let $R0 = 0x00001004$ and $R15 = 0x00004444$

Table 3:

Instruction	Addressing Mode	Effective Address	Register Address (after execution)
LDR $R5, [R0, \#12]$			
MOV $R2, \#14$			

6. (4 points) Give a detailed pictorial representation: the content of $r0$ and memory (memory address and memory data) before and after the execution of the instruction.
STR $r1, [r0], \#4$; $r0 = 0x20008000$, $r1 = 0x76543210$
7. (5 points) Write an assembly language program to find the Largest Number in an array of 10 unsigned integers. Finally, store the largest number in location named "result" in data segment.

Question Part-B
CSE3103– Microprocessor and Micro-Controller
Midterm Exam, Spring Semester 2022
Computer Science and Engineering
University of Dhaka
 Duration: 40 Minutes

This exam contains 3 questions. Answer all the 3 questions. **Total marks is 15.**

1. (5 points) Determine the prescalers value for the following configuration on the STM32F446re micro-controller. You must use the internal 32MHz crystal oscillator.
 - APB1 and APB2 buses will supply 60 and 30 MHz to the connected peripheral.
 - Must set the clock speed at 189 MHz for the AHB bus.
 - Use PLL Clock for the system clock
 - Clock pulse for Serial Audio Interface-1 must not less than 40 MHz
2. (5 points) Any one of the following
 - (a) Configure a timer to generate a clock with of 440 kHz. Show the register values and draw the increment (count up) model. How can we stop a watch based on the 300000 System clock? You must consider this in your design.
 - (b) Let CCRx is a register to compare the value to the clock counter of the timer. It toggles the configured GPIO pin (from high to low or low to high). You can change the CCRx register while the clock is running. Determine and draw the CCRx value (on the clock counter trail) to generate a periodic digital signal for 20KHz.
3. (5 points) Configure USARTx register CR1 and BRR for interrupt enable transmission and reception with baud rate 5 Mbps.

Required Registers from AHB1ENR, APB1ENR, and APB2ENR:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
OTGHS RST									DMA2 RST	DMA1 RST					
rw									rw	rw					
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
			CRC RST					GPIOH RST	GPIOG RST	GPIOF RST	GPIOE RST	GPIOD RST	GPIOC RST	GPIOB RST	GPIOA RST
			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
		DAC EN	PWR EN	CEC EN	CAN2 EN	CAN1 EN	FMP12C1 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			WWOGE 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
								SAI2 EN	SAI1 EN					TIM11 EN	TIM10 EN
								rw	rw					rw	rw
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
										USART6 EN	USART1 EN				
										rw	rw				

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
Pos	Pos	Pos	Pos	Pos	Pos	CKD(1:0)		ARPE	CMS(1:0)		DIR	OPM	URS	UDIS	CEN		
						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		
ARR(15:0)																	
RW	RW	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		
PSC(15:0)																	
RW	RW	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		
Pos	Pos	Pos	Pos	Pos	Pos	Pos	Pos	REP(7:0)									
								RW	RW	RW	RW	RW	RW	RW	RW		

[illegible]

University of Dhaka
Department of Computer Science and Engineering
Incouse Examination
3rd Year 1st Semester, Session: 2020-2021
CSE – 3104, Database Management System II

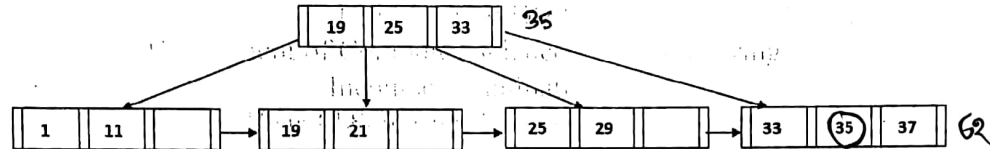
Total Marks: 30

Time: 1 Hour 30 Minutes

(Answer All of the following Questions)

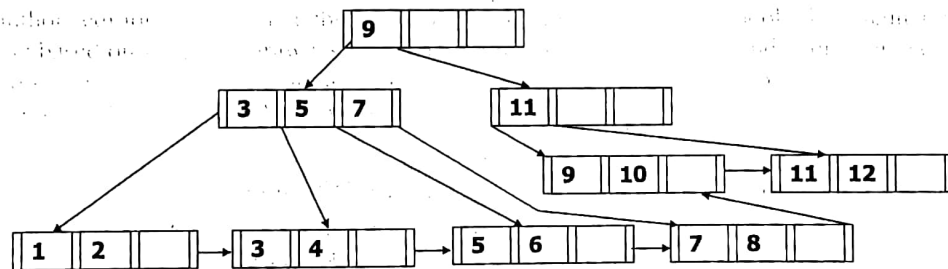
1. a) Consider a 'book' relation in a Library database with schema Book (ISBN, book_name, author, edition, pub_year, publisher, no_of_copies). The relation 'book' is a sequential file based on 'ISBN'. Draw a sparse primary index and a secondary index on 'pub_year'. Populate at least 10 necessary arbitrary tuples of your own for the purpose. 5

- b) Consider the following B⁺tree with n = 4: 25



- Total: Redraw the B⁺Tree after insertion of your class roll no. if it is more than 37; otherwise inset a value which is 2 times of your class roll no. If the value is still less than or equal to 37, repeat the same procedure, i.e. doubling the result. Re-admission students should treat their class roll no. as 201. 3

- c) Remove 9 from the following B⁺tree with n = 4: 2



- d) Indices speed query processing, but it is usually a bad idea to create indices on every attribute, and every combination of attributes, that are potential search keys. Explain why. 2
- e) Find out the causes of bucket overflow in case of hashing. How to handle bucket overflow? 5
- f) What are the benefits of dynamic hashing over static hashing? Is there any limitation of dynamic hashing? 3

3. a) Sometimes linear search is better than other selection algorithms. Explain why. 2

- b) Suppose you have a comparison conditions involving $<$, \leq , \geq or $>$ with an attribute 'A' and a secondary B⁺-tree index is also available on that attribute. Find the cost of selecting the records using the index. 1

- c) Fill up the following table with the terms 'Cartesian product', 'equi-join', 'natural join': 2

Join Algorithm	Applicable for
Nested-loop join	
Block nested-loop join	
Indexed nested-loop join	
Hash join	
Merge join	

- d) What is the effect on the cost of merging runs if the number of buffer blocks per run is increased while overall memory available for buffering runs remains fixed? 2

- e) Suppose a query retrieves only the first K results of an operation and terminates after that. Which choice of demand-driven or producer-driven pipelining (with buffering) would be a good choice for such a query? Explain your answer. 2

- f) Suppose you have to compute $A \gamma_{sum(C)}(r)$ as well as $A, B \gamma_{sum(C)}(r)$. mention how to compute these together using a single sorting of r. 1