FACULTY OF SCIENCE

ACADEMY OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

MODULE CSC2B10
COMPUTER SCIENCE 2B

CAMPUS AUCKLAND PARK CAMPUS (APK)

MAIN EXAM

DATE: 2021-10-29 **SESSION:** 14:00 - 16:00

ASSESSOR(S): MR. T MOODLEY
MS. M FOURIE

MODERATOR: DR. J.L. DU TOIT

DURATION: 120 MINUTES **MARKS:** 100

Please read the following instructions carefully:

1. Downloading and Reading time: 14:00 - 14:10
2. Writing time: - 14:10 - 16:10
3. Upload time: 16:10 - 16:40 (No extra time will be awarded)
4. Test support is available on Discord: https://discord.gg/CTBQhsvM
5. Answers may be typed or hand-written and photographed.
6. Where possible, provide answers in the form of a list.

7. Where possible, upload your submission as a single PDF document.
8. Please DO NOT compress (ZIP, RAR, etc.) your submission.
9. Write *cleanly* and *legibly*.
10. You may use a non-programmable calculator to answer the questions.
11. This paper consists of 5 pages.
12. Upload all of your answers before the close of the submission time at 16:40

QUESTION 1

(a) According to the table below, provide an appropriate description for each property under the appropriate column. (1 mark for each description) ***Write down the letter and the correct answer next to it. e.g. (f) Foo*** [3]

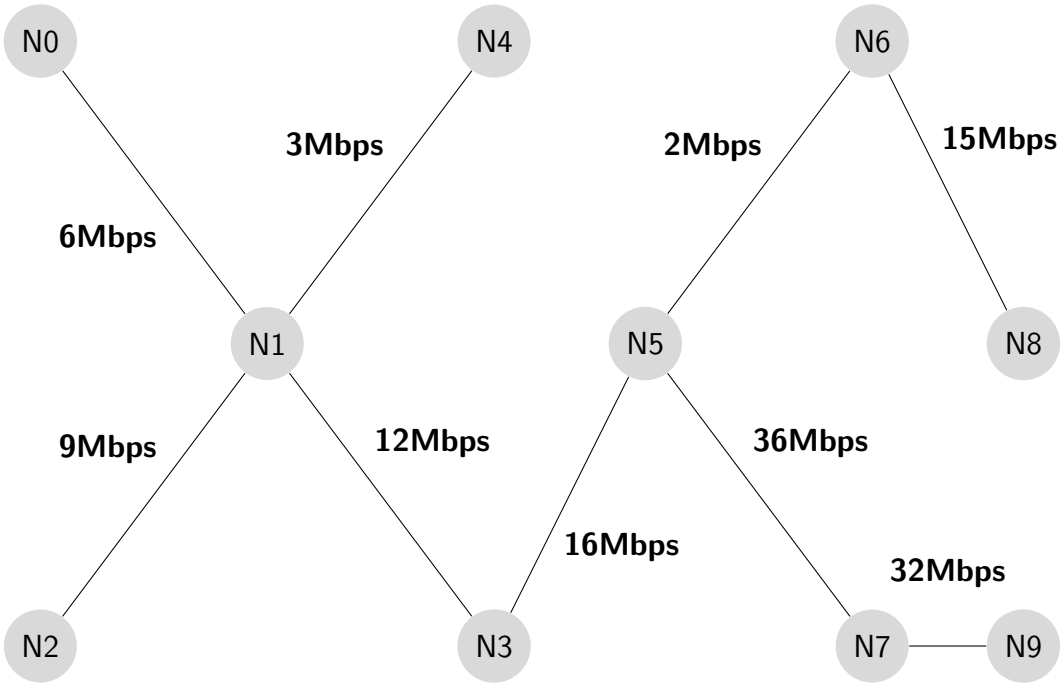
Type of network	CAT6	IEEE 802.11ac
Directionality of Medium	Guided	(a)
Material of Medium	(b)	Radio Signal
Transmission speed	Up to 45 Mbps per channel	(c)

(b) **Throughput** is defined as "the rate at which bits are transferred between sender and reciever". Using the definition *list* and *describe* the different types of throughput. [02]

Total: 5

QUESTION 2

Assume there is a copper network with N0-Nx nodes where, x is the highest number and the transmission rates between these nodes are as follows:



It is also determined that the distances between the nodes are as follows: (Note that all working out must be shown, failure to do this may result in the student receiving zero for the question)

- N0-N1: 20km
- N1-N2: 5km
- N1-N3: 25km
- N1-N4: 15km
- N3-N5: 35km
- N5-N6: 10km
- N5-N7: 60km
- N6-N8: 75km
- N7-N9: 55km

Answer the following questions (Do not round off):

(a) *Determine* the **approximate transmission rate** when communicating between N4 and N9. [1]

(b) Taking this **approximate transmission rate** into account, how *long* (in seconds) will it take to transfer a 180 MegaByte **file** from node N4 to N9? [02]

(c) If it is determined that the copper installed in this network **propagates** a signal at a speed of 100 000 km/s. *Calculate* the **propagation delay** for communications between N4 to N9. [03]

(d) Assuming that there is no nodal processing delay or queueing delay, *calculate* the **total time** taken to transfer a 180 MegaByte file from from N4 to N9? [04]

Total: 10

QUESTION 3

(a) Application protocols define the *message type, message syntax and more*. Both TCP and UDP are protocols within this layer and provide specific services at the application layer, *discuss* these services. [05]

Total: 5

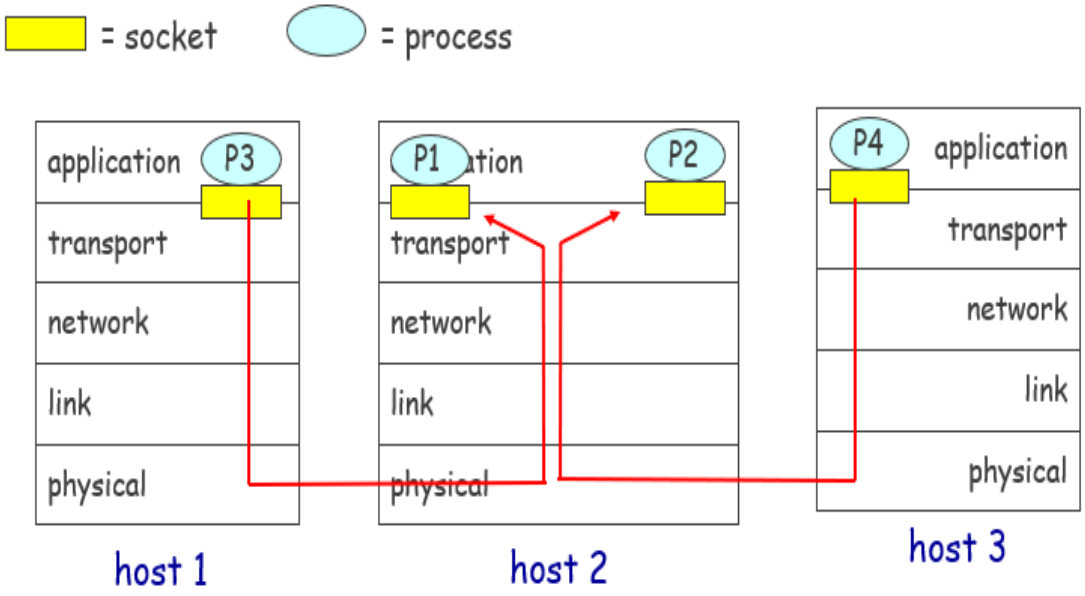
QUESTION 4

(a) Within the application layer, processes in different hosts communicate by exchanging messages. **Fully explain** the concept of a **socket and use a diagram** to support your answer. [05]

Total: 5

QUESTION 5

(a) Using the diagram below, discuss the manner in which multiplexing and demultiplexing works, be sure to make reference to the diagram in your answer. [06]



(b) We have different reliable data transfer mechanisms to ensure the transfer of data is done reliably. In RDT 2.0, what is the underlying recovery mechanism used to recover from errors? [04]

Total: 10

QUESTION 6

The table below represents the payload of a UDP segment. Calculate the **sum** of the following two 16-bit integers, along with their associated 1s complement **checksum**. ***Note that all working out must be shown, failure to do this may result in the student receiving zero for the question***

Number 1	1	1	1	0	0	1	0	1	0	1	0	0	1	0	1	1
Number 2	1	0	1	1	0	0	1	1	1	1	0	0	1	0	0	1

Total: 5

QUESTION 7

(a) In the network layer, we have what is called virtual circuits and datagram networks. *Fully discuss* **virtual circuits** and how they work. *Draw* a diagram to support your answer. [08]

(b) Dynamic Host Configuration Protocol (DHCP) can return more than just the allocated IP address on the subnet. *Explain* what other information you can get from DHCP? [02]

Total: 10

QUESTION 8

Given the following **IP address** and **CIDR**, answer the questions that follow (Note that all working out must be shown, failure to do this may result in the student receiving zero for the question):

5.111.45.213/30

(a) Provide this address in **binary** notation. [02]

(b) How many hosts can this network **accommodate**? [02]

(c) Assuming classful addressing was used, what **class** does this address belong to? [02]

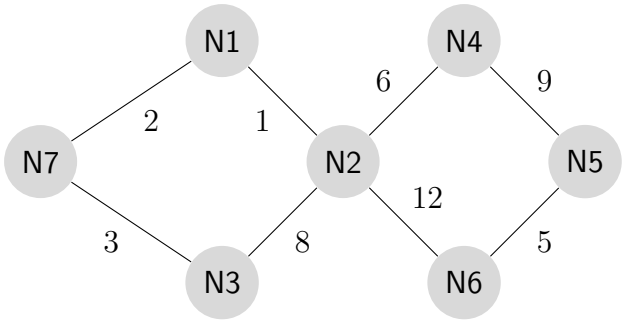
(d) Calculate the **network address** of this block in dotted decimal notation. [02]

(e) Calculate the **broadcast address** of this block in dotted decimal notation. [02]

Total: 10

QUESTION 9

Given the below network **routing graph** (with costs), answer the following questions that follow (Note that all working out must be shown, failure to do this may result in the student receiving zero for the question):



(a) What is the path with the **least cost** when communicating between N6 and N7. Is this the **only** cost effective path? [02]

(b) Given the local datagram **forwarding table** for node N2 below and the destination address is 125.98.47.25, which link will this packet be forwarded to? Please ensure to show all your calculations. [03]

Destination Address range	Output Link Interface
01111101 01100010 00101111 01011***	N4
01111101 01100010 00101111 0001****	N5
01111101 01100010 00101111 000*****	N8
Otherwise	N6

Total: 5

QUESTION 10

(a) Within the context of the **data link layer**, *describe* how the "taking turns" MAC protocol works when the polling approach is used and *discuss* concerns one might have with this approach. [05]

(b) Discuss what **ARP** is and **describe** its basic message types. [05]

Total: 10

QUESTION 11

(a) You have been approached by the University to create an **Android** mobile application which will enable the Protection Services Department to respond to student alerts and monitor campus more effectively. **Describe three** security best-practice principles that would be your main focus in the creation of the app. Give a **reason** why security is an important consideration for such an app. [04]

(b) **Briefly discuss** how the **ipconfig** command works. [01]

Total: 5

QUESTION 12

Provide Java source code for a **UDP Server** bound to port 2021 that that receives a packet and sends a message back. (Note screenshots are not allowed and will be given zero.)

Total: 10

QUESTION 13

The code below illustrates a **TCP client** that receives a binary file using the getfile() method. Fill in the missing code for sections A to I. Clearly label your answers.

```
1  import java.io.*;
2  import java.net.*;
3
4  class TCPBinGet
5  {
6    public void getfile(String address, int port, String filename, int
       length)
7    {
8      File newFile = new File(filename);
9      FileOutputStream fos = null;
10     Socket fileSocket = null;
11     try
12     {
13       fileSocket = __( A (1 marks) )__;
14       InputStream is = __( B (1 marks) )__;
15       fos = new FileOutputStream(newFile);
16       byte[] buffer = new byte[512];
17       int n = 0;
18       int totalBytes = __( C (1 marks) )__;
19       while (totalBytes != length)
20       {
21         __( D (2 marks) )__;
22         __( E (1 marks) )__;
23         fos.flush();
24         __( F (1 marks) )__;
25       }
26     }
27     catch (FileNotFoundException ex) { ex.printStackTrace(); }
28     catch (IOException ex) { ex.printStackTrace(); }
29     finally
30     {
31       if(__( G (1 marks)) )__
32       {
33         try { __( H (1 marks) )__; }
34         catch (IOException e) { e.printStackTrace(); }
35       }
36       if (fos != null)
37       {
38         try {__( I (1 marks) )__ ; }
39         catch (IOException e) { e.printStackTrace(); }
40       }
41     }
42   }
43 }
```

Total: 10

The End!