NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

# Faculty of Computing and Informatics

Department of Computer Science

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| **QUALIFICATION:** BACHELOR OF COMPUTER SCIENCE | |
| **QUALIFICATION CODE: 07BACS** | **LEVEL: 7** |
| **COURSE: Network Design and Performance** | **COURSE CODE: NDP710S** |
| **DATE: June 2019** | |
| **DURATION: 2 hours** | **MARKS: 50** |

| **FIRST OPPORTUNITY EXAMINATION QUESTION PAPER** | |
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| **EXAMINER(S)** | **Mr Peter Gallert** |
| **MODERATOR:** | **Mr Baruani Atumbe** |

**THIS QUESTION PAPER CONSISTS OF 2 PAGES**
(Excluding this front page)

**INSTRUCTIONS**

1. Answer all questions.
2. When answering questions you should be led by the allocation of marks.
3. Do not use or bring into the examination venue books, mobile devices and other material that may provide you with unfair advantage. Should you be in possession of one right now, draw the attention of the examination officer or invigilator.
4. NUST's examination rules and regulations apply.

**PERMISSIBLE MATERIALS**
Calculator is allowed.

1. Briefly describe the following terms:
   (a) Default queue (2)
   (b) Service Level Agreement (3)

2. Given a WAN link of type `E1` (`2,048 kbps`), how many `KiB`, likewise per second, can you transmit? Overhead not considered, `kb`=kilobit, `KiB`=Kibibyte. Submit the steps of your calculation. (3)

3. For the four default traffic classes on a switch, a `100 Mbps` interface has been configured with the following Round Robin command: `wrr--queue bandwidth 3 4 2 1`. How much is the effective net bit rate for:
   (a) Background and best–effort traffic? (1)
   (b) Excellent effort and critical traffic? (1)
   (c) Voice and video? (1)
   (d) Internet and intranet control traffic? (1)

4. In the risk analysis for Shoprite supermarkets in Windhoek, the cost of a supermarket till breaking down is estimated at 5,000 N$ (half the value of the till). The cost of one hour loss of electricity is estimated at 100,000 N$ (one hour of lost revenue for the shop). Critically comment this approach. (5)

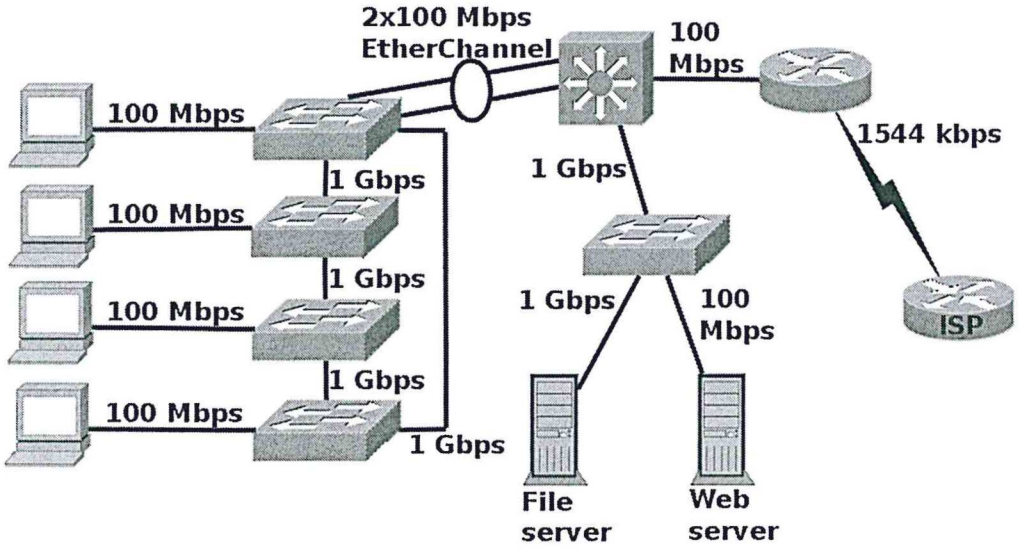
5. The following packets have arrived at a router, in the order given as "Packet #" below. The data units to `2.0.0.7` are `HTTP` traffic, the data units to `3.0.0.10` are an extended `DNS` query, and the data units to `100.0.0.5` are part of a `VoIP` phone call.

   All data units will exit interface `Serial0/0/0`, where the scheduling discipline is Flow–based Fair Queueing.

| Packet # | Source IP | Dest. IP | Protocol | Source port | Dest. port | Bytes |
|---|---|---|---|---|---|---|
| 1 | 10.0.0.6 | 2.0.0.7 | TCP | 65001 | 80 | 113 |
| 2 | 10.0.0.6 | 100.0.0.5 | UDP | 65002 | 1026 | 84 |
| 3 | 10.0.0.2 | 3.0.0.10 | UDP | 65003 | 53 | 64 |
| 4 | 10.0.0.6 | 100.0.0.5 | UDP | 65002 | 1026 | 84 |
| 5 | 10.0.0.2 | 3.0.0.10 | TCP | 65003 | 53 | 895 |
| 6 | 10.0.0.6 | 100.0.0.5 | UDP | 65002 | 1026 | 84 |
| 7 | 10.0.0.6 | 2.0.0.7 | TCP | 65001 | 80 | 695 |

   (a) Indicate how many queues will be formed for these packets, and which packet is in which queue, in which order. (5)
   (b) In which order are the packets sent out of interface `Serial0/0/0`? (7)

6. Consider the following network topology. Each workstation on the left represents 20 user PCs. All switches are Cisco 2950 (24 ports of 100 Mbps plus 2 ports of 1 Gbps). Only the multi–layer switch (MLS) does traffic policing in this network. The web server can be accessed from the outside, while the file server cannot.




(a) Does the **G** in the **G**bps link speeds represent the multiplier *Giga* or the multiplier *Gibi*? Why? (2)

(b) Why are the two servers on a separate access switch, and not in the switch block? Explain briefly. (4)

(c) One inside user intends to download a video from the web server. Briefly describe best–case scenario (1 mark) and worst–case scenario (2 marks) of network performance. (3)

(d) Identify the bottleneck in this network when downloading videos from the web server to a user workstation, in the best–case scenario, and in the worst–case scenario of network performance. (2)

(e) Calculate the usable net bit rate when downloading videos from the web server to a user workstation, in the best–case scenario (1 mark), and in the worst–case scenario (3 marks) of network usage. (4)

(f) If there are no VLANs configured in this network, the `IP` address of which interface, on which device, will be the default gateway of the workstations? (2)

(g) Users of this network complain that Internet access is slow. Make **two different** recommendations of what could be improved (1 mark each), and explain briefly how your suggested change would improve Internet access speed (1 mark each) (4)

*End of question paper*