

## National Examinations -- December 2017

### 16-Elec-B4, Information Technology Networks

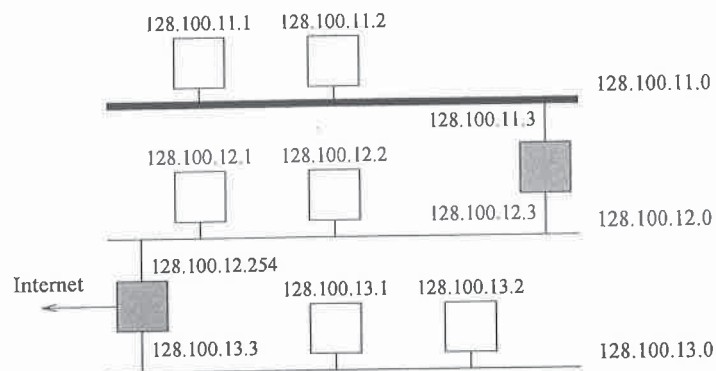
3 Hours Duration

#### Notes:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper a clear statement of any assumptions made.
2. This is a closed book exam. A PEO-approved non-programmable calculator is permitted.
3. There are **5 questions** on this exam. **Any 4 questions constitute a complete paper.** Only the first 4 questions as they appear in your answer book will be marked, unless you **clearly** indicate which questions you want marked **on the front of your exam booklet.**
4. Marks allocated to each question are noted in the left margin. A complete paper is worth 100 marks.

(25 marks) **Question 1.** This question concerns IP packet routing.

- (12 marks) a. Consider the network of LANs in the diagram below. Dark squares are routers, and light squares are hosts. Give the IP routing table at each router, including next hop for each route, netmask, and gateway.
- (8 marks) b. Give, and explain, the path through the network for a packet originating at 128.100.13.2 with destination 128.100.11.1.
- (5 marks) c. Explain the problem of IPv4 address exhaustion, and give one possible solution.



(25 marks) **Question 2.** This question concerns the transport layer.

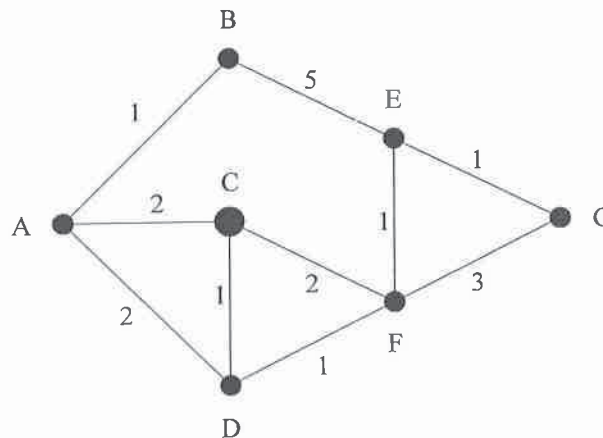
- (5 marks) a. Consider a multi-hop network where each link has different capacity, and where the routers have finite-sized buffers. Why is congestion control necessary in this network?
- (5 marks) b. Why might UDP be a better protocol than TCP for an application such as video streaming?
- (10 marks) c. Using TCP, suppose the initial window size is 1, and the congestion threshold is 16. Assuming all packets are acknowledged, give an example showing how the window size evolves up to and beyond the threshold.
- (5 marks) d. Considering the same setup as in part b, suppose a packet in the third window is not acknowledged. Give the congestion window sizes for the first eight TCP windows.

(25 marks) **Question 3.** This question concerns layered architecture.

- (10 marks) a. Name each layer of the OSI seven-layer model, and describe it in one sentence. (Be brief; marks may be deducted for unnecessary detail!)
- (5 marks) b. Four layers are used in TCP/IP networking: three layers from your answer in part a, and one “layer” that is not part of the OSI model. Name all four layers.
- (10 marks) c. Of the seven layers in the OSI model, name the layer (or layers, if more than one) where each of the following is used or found.
- Local-area networking.
  - Encryption.
  - Routing.
  - End-to-end error correction.
  - SMTP, HTTP, or FTP.
  - Specifications for LTE bands.
  - Character display, such as ASCII.
  - Error detection over a *single* link.

(25 marks) **Question 4.** This question concerns shortest-path routing.

Apply Dijkstra’s algorithm to find the paths from **node F** to all other nodes in the following network, with the given edge distances. Show all work; credit will not be awarded unless Dijkstra’s algorithm is correctly followed.



**(25 marks) Question 5.** This question concerns packet switching and circuit switching.

- (5 marks) a. Explain the difference between packet switched networks and circuit switched networks.
- (5 marks) b. Of packet switching and circuit switching, which one requires centralized scheduling of resources? Briefly explain (1-2 sentences).
- (5 marks) c. Of the following standards, protocols, or methods, state whether it is most useful for packet switching or circuit switching (if there is no difference, say so). Give a one-sentence explanation for each.
- i. FDMA
  - ii. WiFi
  - iii. Public switched telephony
  - iv. TDMA
- (5 marks) d. For data traffic that requires quality of service guarantees, would you pick packet switching or circuit switching (or is there no difference)? Explain in 1-2 sentences.
- (5 marks) e. For bursty (highly irregular) data traffic, would you pick packet switching or circuit switching (or is there no difference)? Explain in 1-2 sentences.