



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 7 Examination in Engineering: March 2021

Module Number: EE7208

Module Name: Advanced Data Communication

[Three Hours]

[Answer all questions, each question carries 10 marks]

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- Q1
- a) State two advantages and two disadvantages of using UDP as the transport layer protocol. [2 Marks]
 - b) Briefly explain multiplexing and de-multiplexing functions happening at the transport layer. [2 Marks]
 - c) What are the parameters used to identify a TCP socket in connection-oriented demultiplexing? [1 Mark]
 - d) Explain how TCP provides reliability for data transmissions at the transport layer. Can we provide reliability for an application using UDP, if yes, how? [1 Mark]
 - e) Which types of applications are suited for TCP and UDP? Give two examples for each type. [2 Marks]
 - f) Explain why flow control is required at the transport layer. How does TCP achieve the flow control? [2 Marks]
- Q2
- a) What are the key security concepts? [1 Mark]
 - b) What is the difference between authentication and authorization? [1.5 Marks]
 - c) Explain the Multi-level Security model. [1.5 Marks]
 - d) What are the essential components of a symmetric cipher? [1.5 Marks]
 - e) If the bit errors are occurred in the transmission of cipher-text characters in 8 bit CFB mode how far does the error propagate? [2 Marks]

- f) In general, Key distribution scheme which uses an access control center and/or a key distribution center which has several central points are vulnerable to attack. Discuss the security implications of such centralization.

[2 Marks]

- Q3 a) i) List the factors considered for routing, to find an optimized route to a destination.
 ii) Explain the use of the back-off algorithm in Carrier Sense Multiple Access with Collision Detection (CSMA/CD).

[2 Marks]

- b) i) Establish the requirement for Multi-Protocol Labelled Switching (MPLS) technology stating the drawbacks of the conventional Internet Protocol (IP) networks.
 ii) Distinguish the functions of control plane and data plane in MPLS architecture.
 iii) List the steps of MPLS operation.

[3 Marks]

- c) Consider the MPLS network given in Figure Q3 for answering the below questions.

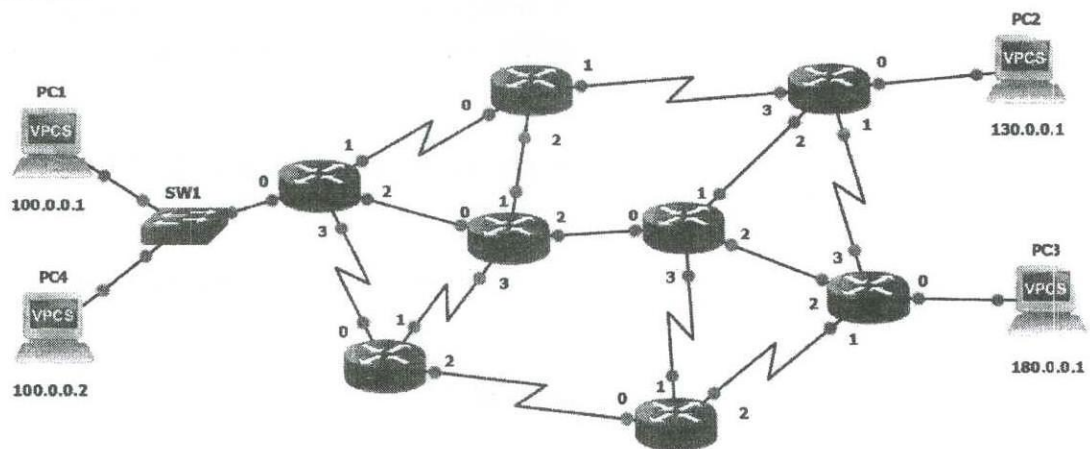


Figure Q3

Label ranges for each router extends to four digits starting from the router number. (e.g. : Router X label range is from X000 to X999)

- i) Identify the Edge and Core Label Switch Routers (LSRs) in the network.
 ii) Develop the relevant Routing Information Bases (RIBs), Forwarding Information Bases (FIBs), Label Information Bases (LIBs) and Label Forwarding Information Bases (LFIBs) for the Label Switched Path (LSP) extending from PC1 to PC2 through R1, R4, R5 and R3.

- iii) Update the LIB, FIB and LFIB of R5 for all possible LSPs from PC1 to PC3 through R5.
- [5 Marks]

- Q4 a) i) Distinguish the functions of “source coding” and “channel coding” used in coding theory.
- ii) State and briefly explain the transmission error types in coding system.
- [2 Marks]

- b) A memory less source emits eight messages with probabilities 0.21, 0.16, 0.03, 0.33, 0.12, 0.03, 0.06 and 0.06.
- i) Compute the entropy of the memoryless source.
- ii) Propose a set of codewords for the above messages using the Huffman coding scheme and determine the average word length.
- iii) Verify the validity of the proposed coding scheme in the part ii).
- iv) Determine the number of redundant bits required for implementing a Forward Error Correction (FEC) scheme.
- [8 Marks]

- Q5 a) Consider the discrete-time Markov chain shown in Figure Q5(a).
- i) Is the chain irreducible? Justify your answer.
- ii) How many state classes does it have and what are the states in each class?
- iii) Identify the transient states and the recurrent states? Give reasons.
- [3 Marks]

- b) Consider the discrete-time homogeneous Markov chain shown in Figure Q5(b).
- i) What does it mean for a Markov chain to be homogeneous?
- ii) Derive the steady-state probabilities for the Markov chain by applying balance equations.
- [3 Marks]

- c) The Erlang B formula determines the probability that a call is blocked. What are the main assumptions of this formula when it is used to calculate the grade of service of a trunked system?
- [1 Mark]

- d) A single GSM service provider supports 10 digital speech channels. The system

which receives 60 calls/hr. Each call lasts an average of 5 minutes.

- i) Calculate the offered traffic intensity of the system.
- ii) Estimate the call blocking probability using the Erlang-B chart in Figure Q5(c).
- iii) Calculate the efficiency of the channel usage (η). Note that η is given by $\eta = \frac{A_{ca}}{C}$ where C and A_{ca} denote the number of channels and the carried traffic respectively. [3 Marks]

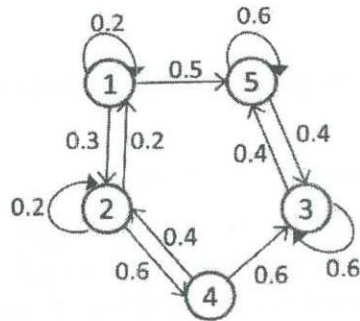


Figure Q5(a)

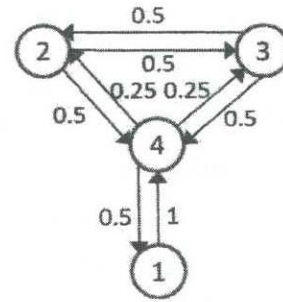


Figure Q5(b)

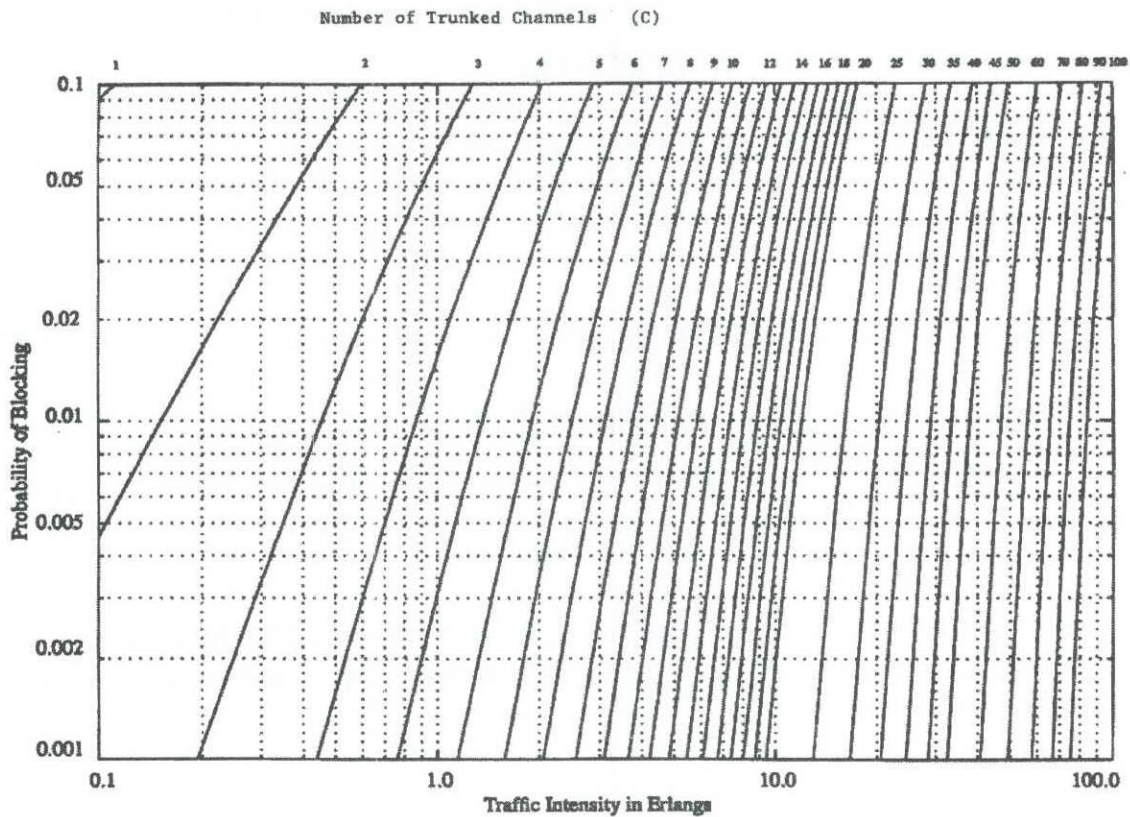


Figure Q5(c): Traffic Intensity in Erlangs-B