Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin

Faculty of Engineering, Mathematics and Science

School of Computer Science & Statistics

M.Sc. Computer Science **Semester 1 2019**
Integrated Computer Science Programme
Year 5 Annual Examinations

Next Generation Networks

Wednesday 11 December **RDS SIM COURT** **17.00-19.00**

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Instructions to Candidates:

- **Answer FOUR questions from Part A, and EIGHT questions from Part B.**

Materials Permitted for this Examination:

- **Calculator**
- **Mathematical Tables**

PART A

Q.1

With regards to wireless local area networks (WLAN):

a) Describe the motivation behind their deployment.

[6 marks]

b) Describe their limitations.

[6 marks]

c) Outline the access point functionalities and mention the main applications of the infrastructure-based mode.

[6 marks]

Q.2

With regards to cognitive radio:

a) What are its desirable features?

[6 marks]

b) What are its applications?

[6 marks]

c) Describe its cross layer issues.

[6 marks]

Q.3

In a certain system the arrivals, which can be modelled as a Poisson process, occur at a rate of one every 200 ms, and the service times are exponentially distributed with mean 2 s. Also, there is no limit in the number of servers available.

a) Give the Kendall's notation, motivating your choice.

[6 marks]

b) Calculate the average number of customers in the system.

[6 marks]

c) Calculate the average delay per customer.

[3 marks]

d) Calculate the average queuing delay. What do you notice? Why it is so?

[3 marks]

Q.4

Considering an optical transmission systems for telecommunications networks:

a) List three different types of optical fibre, explaining their main characteristics, indicating their main advantages and disadvantages.

[9 marks]

b) Describe the role of optical amplifiers in a transmission system, how they are used, how they affect the noise in the system, what is the effect of different span distances and their main advantage and disadvantage over regenerators.

[9 marks]

Q.5

a) Describe what are the main reasons behind the need for convergence of optical and wireless networks and why they are specifically needed for 5G networks. Then explain, using any appropriate diagram, what is the problem for transporting fronthaul signals over a Passive Optical Network (PON) and how can this be solved.

[9 marks]

b) Describe all the evolutionary steps in fronthaul transmission, that brought base stations from being distributed (Distributed Radio Access Network -D-RAN) to becoming centralised (C-RAN), explaining the rationale behind any of these steps.

[9 marks]

Q.6

a) An optical signal with bit rate of 25Gb/s runs over a single mode fibre with dispersion coefficient of 5ps/km/nm. The signal uses non-return-to-zero (NRZ) coding, with a bandwidth of 50 GHz. What is the maximum distance for the link if the maximum tolerable broadening of the optical pulses is equal to 60% of the bit time duration? (Assume the following conversion ratio: 100 GHz = 0.8 nm).

[9 marks]

b) You need to achieve a link distance of 400 km and you must compensate dispersion using dispersion compensating fibre (DCF) with coefficient of -150ps/km/nm. Assuming that the system uses 4 intermediated amplification stations and that the DCF fibre is located in each of these stations, what length of DCF do you need at each station?

[9 marks]

PART B

For each question you pick, select only ONE answer out of the four available options.