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

CS7GV2-1

Faculty of Engineering, Mathematics and Science

School of Computer Science & Statistics

M.Sc. Computer Science Annual Examination **Semester 1, 2020**

Mathematics of Light and Sound

XX–YY January 2021 **"Take at Home"** **09:00-08:59**

Fergal Shevlin, Ph.D.

Instructions to Candidates:

- Answer all **six** questions. All questions carry **equal** marks: 20 each out of 120.
- Use **two hours** as a target for how long you should take to write your answers.
- If you have been granted additional time for written examinations, adjust the suggested target accordingly.
- Provide original and detailed **explanations** in support of your answers.
- Maximum answer length should be **two pages** comprising at most 500 words.
- Email me at **fshevlin@tcd.ie** with any specific queries and I will reply if I can.
- Take pictures of each page and send them to me as attachments to a **single** email. Avoid high resolutions or attachment sizes could cause email problems.
- Note that **collaboration** is not permitted. You must submit a picture of the enclosed declaration signed by you.

Materials permitted for this examination:

- This is an "open book" exam. Feel free to refer to any appropriate sources of information you have available, e.g. lecture notes, textbooks, or internet.
- Non-programmable calculators—indicate make and model.

Question 1. Explain the meaning and effect of every term in a solution for damped simple harmonic oscillation.

[20 marks]

Question 2. Demonstrate two iterations of a wave motion simulation algorithm using some appropriate numerical values as initial conditions for amplitude.

[20 marks]

Question 3. Explain the role of the cental limit theorem in determining a probability density for the phasor components of a wave sum.

[20 marks]

Question 4. Why is the probability density of wave sum intensity a negative exponential function?

[20 marks]

Question 5. Explain the differences between the probability density of the sum of two intensities and the probability density of one intensity.

[20 marks]

Question 6. Explain the role of the Fourier transform in the Fraunhofer approximation of diffraction.

[20 marks]