Introduction to programming – Activity 10

Getting started

☐ Make sure you complete the **Unit Conversion activity** <u>before</u> you start Activity 10

☐ There will be no programming in Activity 10, unless you want to do the calculations in R Studio.

Main exercise

In this exercise, will compare our wave measurements with theory. During the wave tank demonstration, we learned that there are shallow-water waves that interact with the bottom, and deep-water waves that don't interact with the bottom. Both of these waves have different equations to predict their speed (c_p).

For shallow-water waves ($D < L/20$)

$$c_p = \sqrt{gD}$$

For deep-water waves ($D > L/2$)

$$c_p = \sqrt{\frac{gL}{2\pi}}$$

where **L** is the wavelength (m), **g** is gravity (9.8 m/s^2), and **D** the water depth (m).

☐ Based on your values of **D** and **L**, in meters, do you think your wave should be a shallow-water wave or a deep-water wave? Use the values of **D** and **L** (in meters) that you calculated in the Unit Conversion activity and show your calculations.

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☐ Use the values of **D** and **L** (in meters) you calculated and the equations above to predict c_p for your wave in shallow and deep water

   c_p (shallow water): _____

   c_p (deep water): _____

☐ Write down the speed that you calculated for your wave in the Unit Conversion activity. Is it closer to the shallow-water or the deep-water prediction?

   Speed of your wave: _____

   Closer to which predicted c_p? _____

☐ Look at the video for your wave again. Do you see evidence that it moves the dirt at the bottom? What does that tell us about our predictions?

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☐ Look at the video for the extra wave, do you see a difference? What does that tell you about the wavelength of the extra wave? Note: we could not analyze that extra wave because its wavelength is too long and we cannot see two crests in one frame.

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Advanced activities – if your group is done early

☐ **Transition waves.** Based on the wavelength (**L**) of your wave, calculate at which water depths (**D**) it would start interacting with the bottom; It does not need to behave exactly like a shallow-water wave; the depth only needs to be below the limit for deep-water waves.

Calculated value of **D**: _____

☐ Based on the wavelength (**L**) of your wave, calculate at which water depths it would behave like a shallow-water wave.

Calculated value of **D**: _____