CS2201 Worksheet 10

Work out the problems on your laptop/phone (there are several nice python interpreters that work on Android - I prefer qpython or pydroid - but you may find some other app more to your taste. If you do not have access to any of these, write out our answers - scan them and upload (but this should be the absolute last resort!).

You will find link to the relevant videos and lecture slides on welearn.

Q 1) Use the trapz function from the scipy.integrate submodule to carry out the following integral

$$\int_{-1}^{2} \frac{\sin^2 x}{1+\cos x} dx$$

By comparing your result with the exact result (which you should be able to calculate) determine how the error changes with step-size.

Q 2) Repeat the last problem, but this time use the simps function.

Q 3) Use the quad function from the same submodule to determine the following integrals

(i) $\int_0^{\pi} \frac{\sin^2 x}{x^2+1} dx$ (ii) $\int_0^1 x^4 e^{-x} dx$ (ii) $\int_0^1 \frac{x^4}{1+x^3} dx$ (ii) $\int_{-\infty}^{\infty} e^{-x^2} dx$

Note that you can use infinite limits in quad - just use np.inf for ∞

Q 4) Consider the integral

$$I(a,b) = \int_{-\infty}^{\infty} \frac{e^{-ax^2}}{x^2+b^2} dx$$

The result, is of course a function of two variable a and b. The integrand is defined as a function of three variables as

```
f = lambda x,a,b : np.exp(-a*x**2)/(x**2+b**2)
```

Use the quad function to create a table of values for each pair (a, b) where $a \in \{-1, 0, 1\}$ and $b \in \{1, 2, 3\}$

Hint : use the args option of the quad function.