Exercise 02

Self-adjoint operators

PLEASE HAND IN YOUR SOLUTION BEFORE **THURSDAY, 10 NOV, 8.00 A.M.**

2.1 Self-adjoint operators and commutators (10 P)

Show that

- $[\hat{A}\hat{B}, \hat{C}] = \hat{A}[\hat{B}, \hat{C}] + [\hat{A}, \hat{C}]\hat{B}$
- If $\hat{A}$ and $\hat{B}$ are self-adjoint, then $\hat{C} = \hat{A} + \hat{B}$ is self-adjoint.
- If $\hat{A}$ and $\hat{B}$ are self-adjoint, then $\hat{C} = \hat{A}\hat{B}$ is only self-adjoint if $\hat{A}$ and $\hat{B}$ commute (i.e. $[\hat{A}, \hat{B}] = 0$).
- If $\hat{A}$ is self-adjoint, then $\hat{A}^n$ is self-adjoint.
- If $\hat{A}$ is self-adjoint, then $\exp(\hat{A})$ is self-adjoint.

2.2 Python: integers and floats (6 P)

- Assign two integer values to the variables $int1$ and $int2$, where $int2$ should be higher, but not higher than twice $int1$.
- Test this circumstance such that you get the output `"True"`.
- Convert the integers into floats $float1$ and $float2$. Divide $float1$ by $float2$ and save the result to a new variable. Now use integer division (//) instead.

2.3 Python: for and while-loops (8 P)

Use: `import numpy as np`

- Create a numpy array A with 4 elements containing all zeros and create a variable containing the length of A.
- Assign an integer value to each element.
- Using a for loop, calculate the sum over all values of A.
- Calculate the same sum again using a while loop.
- Check your results using the built-in function `sum()`.