Problem set 1
FYS3110

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Problem 1.1(L)

The complex inner product $\langle u|v\rangle$ is linear in its *second* factor, which means: Given $|v\rangle = \alpha\,|v_1\rangle + \beta\,|v_2\rangle$, where $\alpha, \beta \in \mathbb{C}$, then $\langle u|v\rangle = \alpha\,\langle u|v_1\rangle + \beta\,\langle u|v_2\rangle$. However, the complex inner product is *not* linear in its *first* factor.

If $|u\rangle = \alpha\,|u_1\rangle + \beta\,|u_2\rangle$ then $\langle u| = \alpha^*\,\langle u_1| + \beta^*\,\langle u_2|$, now

$$\langle u|w\rangle = \alpha^*\,\langle u_1|w\rangle + \beta^*\,\langle u_2|w\rangle\,, \tag{1}$$

for an arbitrary $|w\rangle$. This leads one to conclude that the complex inner product is *antilinear* in the first factor.

Problem 1.2(L)

The following property holds for the inner product of any two vectors $|\alpha\rangle$ and $|\beta\rangle$

$$\langle\beta|\alpha\rangle = \langle\alpha|\beta\rangle \tag{2}$$