


Finals

I swear upon my honor that I have not given nor received any unauthorized help on this exam and that all the work below are my own.



DESABELLE, Olyn D.

1 Baa Baa Black Sheep [50 pts.]

Consider the process: $e^+e^- \rightarrow e^+e^-$.

- (a) Draw the lowest-order Feynman diagram/s for this process. [10 pts.]

- (b) Does this process have the same number of lowest-order Feynman diagram as the annihilation process $e^+e^- \rightarrow \mu^+\mu^-$ (which only has *one*) considered in class? Why or why not? [5 pts.]

- (c) Use the Feynman rules for QED to write down the corresponding matrix element/s. [10 pts.]

- (d) In the *relativistic* limit (i.e., the masses of e^+ and e^- can be neglected), calculate the spin-averaged matrix element. Your final answer must be written in terms of the Mandelstam variables. [25 pts.]

2 Look At Me Roll [50 pts.]

Consider the process: $e^-e^- \rightarrow e^-e^-$.

- (a) Draw the lowest-order t -channel and u -channel Feynman diagrams for this process. [10 pts.]

- (b) Use the Feynman rules for QED to write down the corresponding matrix elements. [10 pts.]

- (c) In the *non-relativistic* limit (i.e., electron mass is *not* neglected), calculate the spin-averaged matrix element. Your final answer must be written in terms of the Mandelstam variables. [30 pts.]