In the presented work we deal with fixed interval scheduling problem with random delays. We present common formulations of the problem and introduce new ones. The aim is introduction of formulations where the actual cost or penalty is properly expressed and also risk of the schedule is taken into account. The main topic of the work is combining existing formulations for FIS problem with risk measures and creating mixed integer linear formulations of them. The new formulations are minimizing expected number of unprocessed jobs which is better linked to penalties than number of overlaps. For formulations based on risk measures we presented mean-variance optimization of number of overlaps and CVaR optimization of both number of overlaps and number of unprocessed jobs. All of the new formulations were reformulated as mixed integer linear problem. Finally we show a numerical study where we implemented two of the new formulations we presented in this work.