

## OR 603 Sports Analytics

### Assignment 3

Base-Out State Run Expectancy

Base state	0 outs	1 outs	2 outs
000	0.46	0.24	0.09
100	0.82	0.48	0.19
010	1.04	0.62	0.29
001	1.29	0.89	0.33
110	1.40	0.86	0.40
101	1.65	1.13	0.44
011	1.87	1.27	0.54
111	2.23	1.51	0.64

1. In baseball, a steal is an event in which a baserunner attempts to advance one base while the ball is not “in play.” In other words, the ball has not yet been hit. The baserunner tries to steal while the ball is being “pitched” (like “bowled” in cricket), and if he safely reaches the next base before the ball is thrown to that base he succeeds. If the ball is thrown to the base before he arrives, he is *out*.

It is a risky event. If successful, the baserunner is more likely to score. If unsuccessful, the baserunner is removed from the bases and the batting team gains one additional out. Steals usually occur when there is only one baserunner and he is on 1<sup>st</sup> base.

For example, a successful steal with 0 outs goes from state 100-0 to state 010-0, and an unsuccessful steal with 0 outs goes from state 100-0 to state 000-1.

Calculate the *net* value of both a successful steal and an unsuccessful steal starting from 100 in all 3 possible out states.

2. If a baserunner is known to have a 0.65 probability of success at stealing bases (65% success rate), is it generally a good idea for him to attempt to steal?

3. What probability of success would be required for it to be a good idea for a runner to attempt to steal with 0 outs? With 1 outs? With 2 outs?

4. (Optional) Create the run expectancy matrix used for the above problems using the Baseball Event Data file found in the Lesson 3 Content folder. Use any tool you like (Excel PivotTables, R, etc.) Recall that the value of interest is the mean “runs rest of inning (runs.roi)” starting from each base-out game-state.