

Is the 50-40* Tennis Game Optimal?

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Deuce – player has to win 4 points but if the score line reaches 3 points-all then a player must 2 points ahead to win the game

No-Ad – player has to win 4 points but if the score line reaches 3 points-all then the player to win the next point wins the game. At most 7 points are played in the game

50-40 – server has to win 4 points and receiver has to win 3 points. At most 6 points are played in the game

50-40* - server has to win 4 points and receiver has to win 3 points but if the score line reaches 3-2 (40-30) then the player to win two more points wins the game. At most 8 points are played in the game

pA and pB represent the probabilities of player A and player B winning a point on serve
 pA=0.55, pB=0.5 could typically apply to the slowest surface of clay
 pB=0.65, pA=0.6 could typically apply to a medium paced surface such as hard court
 pB=0.75, pA=0.7 could typically apply to the fastest surface of grass

It is assumed that the average time to play a point is 8 secs which can apply to hard court and clay.

	Chances of winning a best-of-5 set all tiebreak set match			
	Deuce	No-Ad	50-40	50-40*
pA=0.55, pA=0.5	79.9%	77.0%	75.4%	77.0%
pA=0.65, pA=0.6	78.5%	76.7%	76.3%	77.8%
pA=0.75, pA=0.7	76.0%	75.9%	77.2%	78.1%

Table 1

	Mean number of points played in the match			
	Deuce	No-Ad	50-40	50-40*
pA=0.55, pA=0.5	255.49	223.95	191.15	208.28
pA=0.65, pA=0.6	256.08	227.42	194.54	212.80
pA=0.75, pA=0.7	264.40	239.83	202.82	220.98

Table 2

	Standard deviation of the number of points played in the match			
	Deuce	No-Ad	50-40	50-40*
pA=0.55, pA=0.5	62.80	52.95	44.99	49.71
pA=0.65, pA=0.6	61.73	53.38	46.27	51.32
pA=0.75, pA=0.7	61.38	55.44	48.28	53.00

Table 3

	Mean amount of time played in the match			
	Deuce	No-Ad	50-40	50-40*
pA=0.55, pA=0.5	3.05 hours	2.67 hours	2.28 hours	2.49 hours
pA=0.65, pA=0.6	3.06 hours	2.72 hours	2.32 hours	2.54 hours
pA=0.75, pA=0.7	3.16 hours	2.86 hours	2.42 hours	2.64 hours

Table 4

	Standard deviation of the mean amount of time played in the match			
	Deuce	No-Ad	50-40	50-40*
pA=0.55, pA=0.5	0.75 hours	0.63 hours	0.54 hours	0.59 hours
pA=0.65, pA=0.6	0.74 hours	0.64 hours	0.55 hours	0.61 hours
pA=0.75, pA=0.7	0.73 hours	0.66 hours	0.58 hours	0.63 hours

Table 5

	Chances of a match going beyond 3 hours			
	Deuce	No-Ad	50-40	50-40*
pA=0.55, pA=0.5	53.5%	34.2%	12.4%	22.3%
pA=0.65, pA=0.6	50.4%	37.6%	12.7%	29.4%
pA=0.75, pA=0.7	53.7%	45.0%	18.6%	31.1%

Table 6

	Chances of a match going beyond 4 hours			
	Deuce	No-Ad	50-40	50-40*
pA=0.55, pA=0.5	15.4%	1.9%	0.0%	0.6%
pA=0.65, pA=0.6	13.5%	2.5%	0.1%	1.0%
pA=0.75, pA=0.7	14.4%	4.9%	0.0%	1.7%

Table 7

The underlying result is that the 50-40* game reduces the time played in the match by 30-35 minutes compared to the deuce game and still keeps the probabilities of the stronger player winning approximately the same. The 50-40 game although very efficient in reducing length, it fails when pA=0.55, pB=0.5 and pA=0.65, 0.60. The 50-40* game significantly reduces the mean and standard deviation of the number of points played in the match and the time played in the match compared to the deuce game. Also, the chances of a match going beyond 3 and 4 hours is significantly reduced compared to the deuce and No-Ad. Hence, the 50-40* appears to be 'optimal'.