

## Waddington's Formula I

One of the more popular board games when I was a child was Waddington's Formula I. This was a bit of an anachronism at the time as pit stops, and in particular tyre changes, were rare. So in one sense it is more relevant in today's market, as it was when designed, than in the heyday of Jim Clark and Jackie Stewart.

Like many games of the period, the printed rules were not exhaustive so many house rules and variants were inevitably created – one of the most logical being a formal staggered grid rather than having the cars lined up side by side – they never did fit properly anyway without overlapping the wheels! The classic was the use of the *Tactic* cards – did they have to last the whole race irrespective of the number of laps, or be re-dealt when the last player used his last one, or be re-dealt after every lap or two completed by the lead car.

As an aside the method used to determine pole was the number of rolls of pairs of dice to get round a lap with any overshoot of the finishing line being a tiebreaker.

Peculiarly the dice were not used for movement; rather each driver chose his own speed according to acceleration and deceleration rules. Where dice came into play was determining penalties of Tyre and Brake wear according to speed over the safe limit for each option of racing line through each of the six corners on the lap. Whilst severe Tyre or Brake wear could occasionally be forced on an opponent by baulking, the majority of wear was invariably down to cornering.

<b>Penalty Chart</b>			
Speed over Safety Limit			
No. on Dice	" +20mph "	" +40mph "	Penalty
2	" +20mph "	" +40mph "	No Penalty
3	" +20mph "	" +40mph "	Spin off but do not alter gauges
4	" +20mph "	" +40mph "	Tyre wear 1
5	" +20mph "	" +40mph "	Tyre wear 1
6		" +40mph "	Tyre wear 2 but if gauge 4 or more spin off and do not register any tyre wear
3+3	" +20mph "	" +40mph "	No Penalty
7		" +40mph "	Tyre wear 1; Brake wear 1
4+4	" +20mph "	" +40mph "	No Penalty
8	" +20mph "	" +40mph "	Tyre wear 1
9		" +40mph "	Tyre wear 1; Brake wear 1
10		" +40mph "	Tyre wear 2 but if gauge 4 or more spin off and do not register any tyre wear
11	" +20mph "	" +40mph "	Spin off but do not alter gauges
12	" +20mph "	" +40mph "	No Penalty

The critical levels for Tyre and Brake wear were 8 and 5 respectively before a visit to the pits became absolutely necessary – basically the car became almost undriveable – so it was felt that races around seven or eight laps were ideal as this would force each player to make at least two if not three pit stops. With six corners to negotiate on each lap the thinking was therefore was along the lines of a stop every other lap.

The most obvious points examining the above table are that fewer penalties were likely for “+20mph” than “+40mph” although both could involve spinning off and therefore essentially restarting from stationery on the next turn, the differential element for some rolls at “+40mph” and the fact that the chart is not symmetrical except for the extreme results of 2,3,11 and 12. And distinction was made between 6 and pair of 3s; 8 and pair of 4s.

Let’s recall our two-dice table:

	1	2	3	4	5	6
1	Total 2 Difference 0	Total 3 Difference 1	Total 4 Difference 2	Total 5 Difference 3	Total 6 Difference 4	Total 7 Difference 5
2	Total 3 Difference 1	Total 4 Difference 0	Total 5 Difference 1	Total 6 Difference 2	Total 7 Difference 3	Total 8 Difference 4
3	Total 4 Difference 2	Total 5 Difference 1	Total 6 Difference 0	Total 7 Difference 1	Total 8 Difference 2	Total 9 Difference 3
4	Total 5 Difference 3	Total 6 Difference 2	Total 7 Difference 1	Total 8 Difference 0	Total 9 Difference 1	Total 10 Difference 2
5	Total 6 Difference 4	Total 7 Difference 3	Total 8 Difference 2	Total 9 Difference 1	Total 10 Difference 0	Total 11 Difference 1
6	Total 7 Difference 5	Total 8 Difference 4	Total 9 Difference 3	Total 10 Difference 2	Total 11 Difference 1	Total 12 Difference 0

The dice rolled are regarded as the same colour so remember, for example for a 10 there are two ways of them falling in the combination 6+4 but only one for 5+5.

For all questions, work out the answer as a fraction of **36** (the total number of permutations), simplify the fraction if possible – such as  $4/36 = 1/9$  and then state the probability of that outcome as a decimal percentage correct to four significant figures (that is, after the decimal point)

1. There are four dice rolls that result in no penalty at “+20mph” as well as “+40mph”.

What is the probability of this happening? \_\_\_\_\_

2. There are two dice rolls that result in spinning off at the corner irrespective of “+20mph” or “+40mph”

What is the probability of this happening? \_\_\_\_\_

3. There are three dice totals that can result in the penalty of Tyre wear 1. Write these three in the first three boxes below but do not simplify the fractions – keep to denominator of 36. Because the events are all independent (OF events) and not conditional on some other event you can add them up to find the solution to the question. Enter your answer in the fourth box. This fraction cannot be simplified. Finally state the probability as a decimal percentage correct to four significant figures (after the decimal point).

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Decimal percentage: \_\_\_\_\_

4. From your answers to questions 2 and 3, what then is the probability of taking a corner at “+20mph” and either spinning off or suffering Tyre wear 1 ?

Fraction: \_\_\_\_\_ Decimal percentage: \_\_\_\_\_

5. What is the probability of taking a corner at “+40mph” and either spinning off or suffering Tyre wear 1 ? There is a simple way of finding the solution without adding up all the individual outcomes...quite simply it is 1 minus probability of no penalty and we have already worked that one out...

Fraction: \_\_\_\_\_ Decimal percentage: \_\_\_\_\_

6. Now work out the probability at “+40mph” of specifically suffering Tyre wear 1 and Brake wear 1...

Fraction: \_\_\_\_\_ Decimal percentage: \_\_\_\_\_

7. With Tyre wear of 4 or more what is the probability at “+40mph” of spinning off?

Fraction: \_\_\_\_\_ Decimal percentage: \_\_\_\_\_

8. With Tyre wear of 3 or less what is the probability at “+40mph” of suffering at least one Tyre wear? Fraction: \_\_\_\_\_ Decimal percentage: \_\_\_\_\_

9. Explain in one sentence why exceeding the safe speed by “+40mph” might not be regularly a wise tactic early in a lap with Tyre wear of 3.

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