

0.1 Tournament Software

makelist

Player records come into email (send by a web page when the player registers) as a database with signups for the various events, and their partners (or an REQ if they request a partner to be assigned).

makedraw

This program follows IBF rules and places the players from a list produced by **makelist** in a draw leaving byes in all the right places. The output is a draw.

drawplot

This program takes the draw output from **makedraw** and plots it up on the screen. The input is a simple ascii file in a particular format, and is currently edited with any standard editor to show the progression of the tournament.

0.2 Tournament Combinatorics and Scheduling

Let us start with a single drop-down draw of N players¹. We will consider four common drop-down formats:

1. Single elimination. If you loose, you are out of the draw. Each player will only be guaranteed 1 match in this format.
This format is also known as “**A**”.
2. Double elimination: two draws, A and B, where the B contains all first round losers from the main (A) bracket. Each player will be guaranteed a minimum of 2 matches. If you loose after that, you can go home.
This format is also known as “**A/B**”.

¹for sake of simplicity, number of players and courts will be powers of 2, typically 4, 8, 16, 32, 64

3. Double elimination single draw, A. Only the top half of a draw is populated. All first round losers are fed back into the A in the next round, but in the lower half of the draw. This is a variation on the double elimination **A/B** scheme whereby the winner of B plays against the winner of A in the true finals. Each player will be guaranteed a minimum of 2 matches. If you lose after that, you can go home. It also ensures that with a bad draw where two strong players play each other in the first round, the loser gets another chance for finals in the bottom half draw.
This format is also known as “**A2**”.
4. Triple elimination: four draws, A, B, C and D. The C draw contains all first round losers in A, the B contains all second round losers in A, and the D contains all first round losers in C. Each player will be guaranteed a minimum of 3 matches. If you lose after that, you are done for the day.
This format is known as “**A/B/C/D**”.
5. Two double elimination: four draws, A, B, C and D, but half the players have been put in the A, half the players in the C draw already. The B contains all first round losers in A, and the D contains all first round losers in C. Each player will be now guaranteed a minimum of 2 matches. It is a special case of 2.
This format is known as “**AB+CD**”.

Now, for these three formats, let us compute some basic numbers like the number of matches played, the number of rounds needed to finish the draw, etc. They are summarized in table 1

format:	A Single	A/B Double	A/B/C/D Triple	AB+CD Double	A2 Double
draw entries	$2N - 1$	$3N - 2$	$4N - 4$	$3N - 4$	$3N - 1$
tot. matches	$N - 1$	$3N/2 - 2$	$2N - 4$	$3N/2 - 4$	$3N/2 - 1$
1st rnd. matches	$N/2$	$N/2$	$N/2$	$N/2$	$N/2$
time slices	$\log_2(N)$	$\log_2(N/2) + 1$	$\log_2(N/4) + 2$	$2 \log_2(N/4) + 2$	$\log_2(N) + 1$

Table 1: Basic numbers for N players in a single event draw in various drop-down formats

Now let us extend this to compute how many matches are needed for a full tournament. This time we assume that for given N players, half of them ($N/2$) will be male, and half female. Also, they all nice pair up in doubles and mixed events. So, there will be $N/2$ players in both singles (MS and WS), $N/4$ teams in both doubles (MD, WD), and $N/2$ teams in mixed (XD). Using the numbers computed in table 1 we then find the following results, as summarized in table 2

	A Single	A/B Double	A/B/C/D Triple	AB+CD Double	A2 Double
Players					
N	$2N-5$	$3N-10$	$4N-20$	$3N-20$	
4	3	-	-	-	
8	11	14	-	-	
16	27	38	44	28	
32	59	86	108	76	
64	123	182	236	172	
128	251	374	492	364	
Courts	$N/2$	$N/2$	$N/2$		

Table 2: Basic numbers for a full 5-event (MS,WS,MD,WD,XD) tournament with $N/2$ men and $N/2$ women, filled draws, 3 events per player.

0.3 Scheduling on limited courts

The above derivations all assume that there are plenty of courts to put all matches on court when they can be played. Of course in reality this is not the case. For a simple draw of N players, one needs $N/2$ courts. So, let us assume there are only C courts ², where C will often be less than $N/2$. The number of timeslices (rounds of full courts if you wish) needed to finish a single elimination A draw of N players can be shown to be:

$$\log_2 N + \sum_{i=1}^{\frac{N}{4C}} (2^i - 1) \quad N \geq 4C$$

where the last summation term is only needed when the number of courts is not sufficient to place all first rounds on court at the same time, *i.e.* ($N \geq 4C$). Using the well known formula

$$\sum_{k=0}^n x^k = \frac{x^{n+1} - 1}{x - 1}$$

we then obtain

$$\log_2 N + 2^{\frac{N}{4C} + 1} + \frac{N}{4C} - 2 \quad N \geq 4C$$

which for a few common cases are computed in Table 0.3 below.

N	2	4	8	16	32	64	128
C							
1	1	3	7	15	31	63	127
2	1	2	4	8	16	32	64
4	1	2	3	5	9	17	33
8	1	2	3	4	6	10	18
16	1	2	3	4	5	7	11
32	1	2	3	4	5	6	8

Table 3: Scheduling: number of timeslices needed for given number of players (N) and number of courts (C)

We can expand this formula for a double elimination A/B,

$$2 \log_2 N/2 + 2^{\frac{N}{8C} + 2} + \frac{3N}{4C} - 4 \quad N \geq 8C$$

²again we are assuming C is a power of 2

and triple elimination A/B/C/D format,

$$4 \log_2 N/4 + 2^{\frac{N}{16C}+3} + \frac{3N}{4C} - 8 \qquad N \geq 16C$$