Annex 9 FMJD rating system and its application rules

The annexes written in English are juridical superior to other translations.
Each federation should make a copy available to its members, either systematically or on demand, in its own language and up dated.
The General Assembly of 1982 ratified it and it has been adapted by the General Assembly's 1984, 1986, 1988, 1990, 1992, 1994, 2009, 2013
The total text was revised after the General Assembly 2013.

1. Introduction

1.1 Goal of the rating system.
To assign a rating to each draughts player belonging to a national federation affiliated to the FMJD, participating in official competitions of the FMJD and recognized international and national competitions of the FMJD, according to results realized in these approved competitions.
The FMJD establishes several international rating lists:
a. the players in international draughts on 100 squares (male and female)
b. the players in 64 squares draughts (male and female)

1.2 Competitions.
1.2.1 The following competitions are used for ratings calculations:
1.2.1.2 all official competitions of the FMJD (including Confederations)
1.2.1.2 all national championships (also qualification rounds)
1.2.1.3 any other competition announced to the FMJD (office and/or Tournament Director) at least 2 weeks before the 1st round
1.2.2 Additional conditions for the competitions:
1.2.2.1 Official time control described in Annex III.
~~1.2.2.2 Other time controls (not shorter than 3 hours per round) are also possible but such competitions are not calculated for titles and the development factor is reduced by 50% compared to art. 3.2.3~~
1.2.2.2 Time controls with a minimum of 3 1/2 hours total for both players for the first 60 moves fully count for rating. Other time controls, not shorter than 2 hours total for both players for the first 60 moves, are also possible but for such competitions the development factor is reduced by 50% compared to art.3.2.
1.2.2.3 General rules of annex 3 are used.
1.2.2.4 Financial conditions as described in the Bye Laws of the FMJD.

1.3 The reporting of competitions.
The reporting of the competition is always the duty and the responsibility of the main referee. It should be done fully according to article 4 of this annex.
If the referee has not fulfilled its obligation, the report must be made by the tournament director of the FMJD, Confederation or Federation, depending on type of the competition.

1.4. Use of the rating system
The role of the General Assembly is to set the policy for the allocation of titles. The role of the rating system is to provide scientific measurements of the best statistical quality that allow the FMJD to give titles of equal value for equal performances.

1.5 *National ratings and FMJD ratings*
To estimate the strength of a player without rating for use in the Swiss system on rating the

national rating of the player may be used. However this estimated rating does not count for the calculation of rating or title norms for the other players.
If a player does not have an FMJD rating, but she has an FMJD women's rating we use the formula to calculate the FMJD rating from the women's rating.
If a player has only a national rating we use this national rating and the formula given below to estimate the FMJD rating of a player.
Only if we have a player without any rating it is up to the referee to make an estimation as good as possible.
The Technical Committee will publish the formulas to calculate the FMJD rating from the national rating every two year by using statistical methods in comparing the ratings for players who have an FMJD rating and a national rating. These formulas will be published regularly on the FMJD website based on basic data received from National Federations.
From 2010 the following formulas are valid

~~**FMJD = 0,855***~~	~~**FMJD Women**~~	~~**+ 173**~~
FMJD = 0,65*	**Poland**	**+ 569**
FMJD = 0,91*	**Russia**	**- 87**
FMJD = 0,4*	**France**	**+1266**
FMJD = 0,89*	**Brazil**	**+ 15**
FMJD = 0,35*	**Belgium**	**+1286**
FMJD = 0,072*	**Italy**	**+1776**
FMJD = 0,575*	**Estonia**	**+ 718**
FMJD = 0,468*	**CzechR**	**+1193**
FMJD = 0,783*	**kndb**	**+1150**

Example 1:
Mr.X wants to play in an FMJD competition. He is not on the FMJD list but he is on the KNDB list with rating 1200. We calculate an estimation for his FMJD rating by using:
FMJD=0,783*1200+1150 = 2089,6 = 2090.
So we can put Mr.X on the competition list with a technical rating of 2090.
Example 2:
We are playing a tournament "Swiss on rating" in Italy. We have a player from Estonia. Using our formulas we can estimate his 'technical Italian rating'. This player has a rating 2540 in Estonia. We need his Italian value.
So, lets do it:
0,072*Italy+1776=0,575*Estonia+718
Italy=(0,575*Estonia+718-1776)/0,072, so Italy=(0,575*Estonia-1058)/0,072
we are ready for the final calculations: Italy=(0,575*2540-1058)/0,072 = 5590

To make the calculations easier the FMJD has published an Excel document on the FMJD website. The FMJD will also provide links on the website to the national website to find the national ratings of players.

2. General Principles

2.1 Principle of the system (ELO system).
The FMJD rating system is a numerical system in which the results in percentages are converted into differences in rating and, conversely, rating differences are converted into probabilities of results

2.2. Base of the system
The base of the system is the Gaussian function of the theory of statistics. It is shown in the conversion table specified in Article 2.3.

2.3 Table to convert results into rating differences.
Interpolation formula.
The interpolation formula for the rating difference D(Pr) belonging to non-integral percentages Pr is:

$D(Pr) = D(P_1) + (Pr - P_1) [D(P_1+1)-D(P_1)]$...
P_1 being the integral number of Pr

Conversion table from the result in percentage P to the rating difference D (P)

P	D(P)	P	D(P)	P	D(P)	P	D(P)
1,00	935,00	0,75	192,71	0,50	0,00	0,25	-192,71
0,99	664,74	0,74	183,80	0,49	-7,14	0,24	-201,82
0,98	586,85	0,73	175,05	0,48	-14,34	0,23	-211,82
0,97	537,54	0,72	166,54	0,47	-21,48	0,22	-220,57
0,96	500,31	0,71	158,11	0,46	-28,71	0,21	-230,42
0,95	470,00	0,70	149,82	0,45	-35,38	0,20	-240,48
0,94	444,00	0,69	141,65	0,44	-43,14	0,19	-250,80
0,93	421,62	0,68	133,62	0,43	-50,40	0,18	-261,51
0,92	401,51	0,67	125,71	0,42	-57,62	0,17	-272,62
0,91	383,02	0,66	117,82	0,41	-64,97	0,16	-284,14
0,90	366,17	0,65	110,11	0,40	-72,37	0,15	-296,14
0,89	350,37	0,64	102,40	0,39	-79,77	0,14	-308,68
0,88	335,71	0,63	94,80	0,38	-87,28	0,13	-321,80
0,87	321,80	0,62	87,28	0,37	-94,80	0,12	-335,71
0,86	308,68	0,61	79,77	0,36	-102,40	0,11	-350,37
0,85	296,14	0,60	72,37	0,35	-110,11	0,10	-366,17
0,84	284,14	0,59	64,97	0,34	-117,82	0,09	-383,02
0,83	272,62	0,58	57,62	0,33	-125,71	0,08	-401,51
0,82	261,51	0,57	50,40	0,32	-133,62	0,07	-421,62
0,81	250,80	0,56	43,14	0,31	-141,65	0,06	-444,00
0,80	240,48	0,55	35,38	0,30	-149,82	0,05	-470,00
0,79	230,42	0,54	28,71	0,29	-158,11	0,04	-500,31
0,78	220,57	0,53	21,48	0,28	-166,54	0,03	-537,54
0,77	211,05	0,52	14,34	0,27	-175,05	0,02	-586,85
0,76	201,82	0,51	7,14	0,26	-183,80	0,01	-664,74
						0,00	-935,00

P is the result percentage.
D(P) is the rating difference between a player and his opponent(s)
2.4 Conversion table for the expected percentage as function of the rating difference

2.4.1 Formula

The expected percentage as function of the rating difference is calculated with the help of the following formula:

$$\mathbf{Pe = \frac{D(Pe) - D(P_1+1)}{D(P_1+1) - D(P_1)} + P_1}$$

P_1 is is the percentage for which $D(P_1) <= D(Pe) <= D(P_1+1)$
P_1 being the integral number of Pr

2.4.2 Conversion table from the rating difference to the expected percentage result for the higher rated player (H) and the lower rated player (L) is presented in the end of this annex.

An example of how this table was created from the table in article 2.3
Player rating = 2150, average rating of his opponents = 2050

$$Pe = \frac{100 - 102,40}{102,40 - 94,80} + 0,64 = (-2,4/7,6) + 64 = 63,6842\%$$

3. Application formula of the rating system

3.1 Performance of a player
General Formula.
Evaluation of the performance of a player. The performance rating of a player in a competition (independent from his new rating at the end of the competition) is given by the formula:

Rp = Rc + D(P)

where:
Rp is the performance rating
Rc is the average rating of the opponents (or average performance)
D(P) is the rating difference based on the percentage of the result as given in table 1, article 2.3.2
Example:
Player rating = 2150, average opponents rating = 2050,
players result = 9 points in 7 games (64,286%)
Rp = 2050 + 102,40+(64,286-64)(110,11-102,40)=2050 + 104,6 = 2155*

3.2 Calculation of the difference in rating

3.2.1 Calculation of the expected result

The expected result is calculated by the formula:

$$We = Pe * \frac{2 * \text{number of games}}{100}$$

where Pe is the expected percentage based on the difference in rating between the player and the average rating of the opponents as given in table 2, article 2.4.2.

Example:

Player rating = 2150, average opponents rating = 2050, tournament has 7 rounds.

Pe (from example 2.2.2) 63,6842%

We = 63,6842*2*7/100 = 8,9158

3.2.2 General formula

The change in rating after a performance (competition/event) is given by:

$$\Delta R = 0{,}5*K(W - We)$$

where:

ΔR is the change in rating

W is the score of the player in the tournament (not counting regulatory results): 2 for winning, 1 for a draw.

We is the expected result based on the rating difference

K is the development coefficient

Example:

Player rating = 2150, average opponents rating = 2050,

players result – 9 points in 7 games (64,286%)

*ΔR = 0,5*15* (9 - 8,9158) = 7,5*0,0842 = 0,6315 or ΔR = 0,5*10* (9 - 8,9158) = 0,421, ...*

3.2.3 The development coefficient K

The development coefficient K is used as stabilizing factor in the system.

K = 25 for a player new to the rating list until he has completed events with at least 30 games

K = 15 as long as a player's rating remains under 2300

K = 10 once a player's published rating has reached 2300 and remains at that level subsequently, even if the rating drops below 2300.

K may change within one calculation period.

Also tournaments with reduced thinking time are accepted for the FMJD rating system. If the thinking time is at least 3 hours per game, the development factor K in the rating calculation is reduced to 50 % of the normal factor.

3.3 Calculating the new rating after a period

3.3.1 General formula for players who have played 25 games or more.

The new rating after one or more performances may be calculated by:

$$Rn = R_o + \Sigma\Delta R$$

where:

R_o is the old rating

Rn is the new rating

ΣΔR is the sum of the rating changes as calculated by the formulas given in article 3.2.

3.3.2 Special case for a player who did not yet play 25 games
The new rating after one or more performances is equal to the average performance of the player:
For the first result the rating is calculated by the formula in article 3.1.1: Rp = Rc + D(P).
To avoid difficulties with players with 0 % or 100 % the maximum is set to 2400 and the minimum to 1900.
The performance after a next result may be calculated by the linear interpolation formula:

$$\mathbf{Rp} = \frac{\mathbf{NP_0 * R_0 + NP_1 * R_1}}{\mathbf{NP_0 + NP_1}}$$

where:
R_o = performance rating until the new result
R_1 = performance of the new result as given by formula 3.1.1
NP_o= number of games played until the new result
NP_1 = number of games from the new result

4. Procedure for the report of a competition

4.1 ***The competition should be reported to the FMJD within 7 days after the last round.***
This is the deadline, and as it written in article 1, the main referee is personally responsible for this. The report should be send via email to the fmjd office and the fmjd rating service (ratings@fmjd.org).
The actual addresses should be checked on the FMJD web-site.

4.2 *The report consists of:*
4.2.1 Information about the competition:
4.2.1.1 information about the referee staff (names, contacts - specially emails, languages)
4.2.1.2 basic information about the competition (name, dates, place, sponsors, ...)
4.2.1.3 basic technical facts about the tournament (system, time control, etc..)
4.2.1.4 clear and full information about any special technical cases (winning games by referee decisions etc.)
4.2.1.5 any other remarks if necessary

4.2.2 Tournament results
It should be done in one clear table. In individual tournaments it is not useful to send the results round by round.
The following information should be presented in the table:
4.2.2.1 FMJD-ID
4.2.2.2 First Name
4.2.2.3 Surname
4.2.2.4 FMJD-title
4.2.2.5 FMJD-rating
4.2.2.6 country
4.2.2.7 birthday (obligatory for the players without FMJD-ID)
The FMJD-IDs of all players may always be found on the FMJD web site as a text file and a database file.
4.2.4 A report must be made in one of official languages of the FMJD. Any Dutch, Polish, German, Italian, …, Japanese texts are FORBIDDEN.

4.2.5 Other remarks:
4.2.5.1 **First Names and surnames always should be presented using only English letters**. The maximum length for each – 17 letters.
4.2.5.2 It is forbidden to use short versions like A.Dames or Jacek v/d Big. ALWAYS use full first names and surnames.
Example of a CORRECT presentation of a swiss tournament:
19245 gmi Andrew Svitskovsy jp 2/27 2/32 1/2 2/7 2/3 0/4 2/5 11
17456 Gerd van den Bigger nl 2/29 2/11 1/1 1/6 1/4 2/5 1/3 10

4.3 Period of validity of a rating list
The rating list is valid for a 3 month period. It is valid for the tournament results received in the 3 month period between two lists. The lists are published on January 1, April 1, July 1 and October 1 of each year.

4.4 Period of the validity of a rating
The period for the validity of a rating is from December 15 to March 15 (more or less), from March 15 to June 15, from June 15 to September 15 and September 15 to December 15. All tournaments ended in this period are used the calculate the rating of the following list.

4.5 The deadline for sending the tournament reports
The reports have to be sent to the FMJD within 7 days after the last round of the tournament.

4.6 National ratings official
Every national federation has to assign someone responsible for the coordination with the FMJD and responsible for sending the tournament results to the FMJD. His name has to be given to the FMJD bureau.

4.7 Errors
Incomplete reports, reports not sent or sent too late are not taken into consideration.

5. Procedure of calculations

5.1 Control of the general referee report
After reception of the result, the responsible verifies the general referee report for the validity of the ratings and for the attribution of titles.

5.2 Own rating
This is the rating published on the official rating list valid on the day of the 1st round of the competition. Players without rating (not present on list a, list b or list c) get a rating of 2100 as his own only for calculation of title norms. For exclusively women competition this value is 2000.

5.3 Calculation of the average rating of the opponents
Games with players without rating (not present on list a, list b or list c) are not taken into account. Games which are not played do not count for rating.
5.4 Calculation of the rating changes
After each tournament the responsible for fmjd rating calculates the change in rating Delta R of every participant by using the formula in Article 3.2.1. with the right coefficient K.

5.5 Calculation of the new rating
The new rating for the next list (see article 3.3) is calculated after the closing date when all

tournament results received have been calculated for all players.

6. Official rating list

The FMJD publishes several rating lists:

a. The official FMJD rating list will be formed from players who are active, i.e.:
- players with rating above 2350 having played at least 30 games counting for rating in the last 3 years.
- players with rating below 2351 having played at least 1 game counting for rating in the last 3 years.

b. The full FMJD rating list consisting of all players with a valid rating

Other special lists may be published also, like lists of youth players etc.

6.1 Frequency of the rating list

Four times in a year the responsible for the rating prepares a new rating list which is published after agreement of the FMJD. The list is published in decreasing order of ratings for all players. ~~with a rating above 2200~~. All players with a valid rating will be published on an alphabetic list.

6.2 Publication of the rating list

The rating publication has the following parts

a. the closing date for the period, normally March 15, June 15, September 15, December 15. Only in exceptional cases a tournament reported after this date is taken into consideration.
b. the date of application, normally January 1, April 1, July 1, October 1.
c. The list of tournaments calculated;
d. the rating of all players in the list;
f. the number of games valid and calculated for each player since the start of the rating list.

6.3 Lists A, B and C

The players are classified in three categories A, B and C. The players with a rating lower than 2300 and a minimum of 30 games and the players with a rating above 2300 and a minimum of 50 games (for the players with a rating above 2351 minimum 30 played last 3 years) are on list A. The other players who did play in the last three years are put on list B and the other players on list C.

6.4 Players who are not active.

Players who did not play during 3 years will be put on list B and players who did not play for 5 years are put on list C.

6.5 Players without rating

For the calculation of titles players without rating get a rating of 2100. For exclusively women competition this value is 2000.

The rules for titles are described in Annex 10.

7. Control of the functioning of the rating list

7.1 Level of rating

The level of the rating is arbitrary. Only the differences in rating have a meaning in terms of probabilities.

7.2 Validity of the system
The validity of the system is respected if the same rating expresses the same strength of a player from year to year.

7.3 Detection of deviations in the rating system
The responsible person for the FMJD rating system has the important task to study deviations in the rating system and to preserve the validity of the rating system.

7.4 Possible study of changes in the rating system
The detection of changes in the rating system may be made by :

a. studying the rating of a chosen group of players, e.g. from 25-40 years old, to detect a possible change in the average rating of the group.
b. studying the average rating of the top 50 players.
c. studying of the division of ratings for the whole group of players.

8. Competence of the responsible person of the FMJD rating system

8.1 Knowledge of the theory
The responsible needs to have an adequate knowledge of the theory of statistical probabilities in their application to the physical and behavioral sciences.

8.2 Study of changes
He must be able to organize the studies described in article 7.5 and interpret the results and, if necessary, give advice to the Executive Board to take measures to preserve the validity of the rating system.

8.3 Understanding the impact of new players.
He needs to be able to determine the overall composition of all rated players and the direction of change. In particular, he must understand the impact of new players who are progressing on the whole; he must also be sensitive to changes in the value of players based on age.

8.4 Help to federations
He has to be willing to help a national federation that wants to establish a national rating system, comparable with the FMJD rating system.

8.5 Objectivity
In all his activities for the rating system he needs to show the same objectivity as which can be expected form a referee of the FMJD.

9. Summary of abbreviations used

Pr : Realized percentage for a player in a tournament;
D(P) : theoretical difference in rating
N : Number of participants in a tournament;
Rp : Performance rating of the players Rp = Rc + D(P)a
Rc : Average rating of the opponents
Rm : Average rating of the participants with Ru = 2100 (2000 for the women) for players without rating (only for Annex 10),
ΔR : Change in rating
W : Realized score in a tournament (2 points for winning, 1 point for a draw and 0 points for a loss)
We : Expected score
Pe : Expected percentage
K : Development coefficient
M : number of opponents
Rn : New rating
Ro : Original rating before the start of a tournament
∑ΔR : Sum of the rating changes
Ru : theoretical rating for players without rating, 2100 (2000 for women), only for titles, see Annex 10

10. Application of these regulations

The initial rating has been calculated by using official international competitions since the World Championship in Arco in 1978 and also other recognized international individual and team competitions and national championships since the World Championship in Bamako 1980.
The first rating list of January 1, 1983 serves as starting point of the FMJD rating system.
After January 1, 1983, all recognized tournaments have been calculated for the FMJD rating.
After January 1,1984 also all national championships, finals and semi finals, have been taken into consideration.
The same regulations are valid for the rating list of the players in the section 64.
The first rating list for the section 64 has been calculated after the world Championship 1985 in Lecce. After that date all recognized tournaments have been calculated for the 64 rating list.
The same rules have been used for a number of years for the rating list of the correspondence players since 1987.

Expected percentage as function of the rating difference

1st column - ratings difference, 2nd column - theoretical result for highest rating, 3rd column - for lowest rating

0	50.0000	50.0000	48	56.6694	43.3306	96	63.1579	36.8421
1	50.1401	49.8599	49	56.8072	43.1928	97	63.2895	36.7105
2	50.2801	49.7199	50	56.9449	43.0551	98	63.4211	36.5789
3	50.4202	49.5798	51	57.0831	42.9169	99	63.5526	36.4474
4	50.5602	49.4398	52	57.2216	42.7784	100	63.6842	36.3158
5	50.7003	49.2997	53	57.3601	42.6399	101	63.8158	36.1842
6	50.8403	49.1597	54	57.4986	42.5014	102	63.9474	36.0526
7	50.9804	49.0196	55	57.6371	42.3629	103	64.0778	35.9222
8	51.1194	48.8806	56	57.7756	42.2244	104	64.2075	35.7925
9	51.2583	48.7417	57	57.9141	42.0859	105	64.3372	35.6628
10	51.3972	48.6028	58	58.0517	41.9483	106	64.4669	35.5331
11	51.5361	48.4639	59	58.1878	41.8122	107	64.5966	35.4034
12	51.6750	48.3250	60	58.3238	41.6762	108	64.7263	35.2737
13	51.8139	48.1861	61	58.4599	41.5401	109	64.8560	35.1440
14	51.9528	48.0472	62	58.5959	41.4041	110	64.9857	35.0143
15	52.0924	47.9076	63	58.7320	41.2680	111	65.1154	34.8846
16	52.2325	47.7675	64	58.8680	41.1320	112	65.2451	34.7549
17	52.3725	47.6275	65	59.0041	40.9959	113	65.3748	34.6252
18	52.5126	47.4874	66	59.1392	40.8608	114	65.5045	34.4955
19	52.6527	47.3473	67	59.2743	40.7257	115	65.6342	34.3658
20	52.7927	47.2073	68	59.4095	40.5905	116	65.7639	34.2361
21	52.9328	47.0672	69	59.5446	40.4554	117	65.8936	34.1064
22	53.0719	46.9281	70	59.6797	40.3203	118	66.0228	33.9772
23	53.2102	46.7898	71	59.8149	40.1851	119	66.1496	33.8504
24	53.3485	46.6515	72	59.9500	40.0500	120	66.2763	33.7237
25	53.4869	46.5131	73	60.0851	39.9149	121	66.4030	33.5970
26	53.6252	46.3748	74	60.2203	39.7797	122	66.5298	33.4702
27	53.7635	46.2365	75	60.3554	39.6446	123	66.6565	33.3435
28	53.9018	46.0982	76	60.4905	39.5095	124	66.7833	33.2167
29	54.0435	45.9565	77	60.6257	39.3743	125	66.9100	33.0900
30	54.1934	45.8066	78	60.7608	39.2392	126	67.0367	32.9633
31	54.3433	45.6567	79	60.8959	39.1041	127	67.1631	32.8369
32	54.4933	45.5067	80	61.0306	38.9694	128	67.2895	32.7105
33	54.6432	45.3568	81	61.1638	38.8362	129	67.4159	32.5841
34	54.7931	45.2069	82	61.2969	38.7031	130	67.5424	32.4576
35	54.9430	45.0570	83	61.4301	38.5699	131	67.6688	32.3312
36	55.0799	44.9201	84	61.5632	38.4368	132	67.7952	32.2048
37	55.2088	44.7912	85	61.6964	38.3036	133	67.9216	32.0784
38	55.3376	44.6624	86	61.8296	38.1704	134	68.0473	31.9527
39	55.4665	44.5335	87	61.9627	38.0373	135	68.1719	31.8281
40	55.5954	44.4046	88	62.0957	37.9043	136	68.2964	31.7036
41	55.7242	44.2758	89	62.2287	37.7713	137	68.4209	31.5791
42	55.8531	44.1469	90	62.3617	37.6383	138	68.5455	31.4545
43	55.9820	44.0180	91	62.4947	37.5053	139	68.6700	31.3300
44	56.1185	43.8815	92	62.6277	37.3723	140	68.7945	31.2055
45	56.2562	43.7438	93	62.7606	37.2394	141	68.9191	31.0809
46	56.3939	43.6061	94	62.8936	37.1064	142	69.0428	30.9572
47	56.5317	43.4683	95	63.0263	36.9737	143	69.1652	30.8348

144	69.2876	30.7124	194	75.1416	24.8584	244	80.3411	19.6589
145	69.4100	30.5900	195	75.2514	24.7486	245	80.4380	19.5620
146	69.5324	30.4676	196	75.3611	24.6389	246	80.5349	19.4651
147	69.6548	30.3452	197	75.4709	24.5291	247	80.6318	19.3682
148	69.7772	30.2228	198	75.5807	24.4193	248	80.7287	19.2713
149	69.8996	30.1004	199	75.6905	24.3095	249	80.8256	19.1744
150	70.0217	29.9783	200	75.8002	24.1998	250	80.9225	19.0775
151	70.1423	29.8577	201	75.9100	24.0900	251	81.0187	18.9813
152	70.2630	29.7370	202	76.0195	23.9805	252	81.1120	18.8880
153	70.3836	29.6164	203	76.1278	23.8722	253	81.2054	18.7946
154	70.5042	29.4958	204	76.2362	23.7638	254	81.2988	18.7012
155	70.6248	29.3752	205	76.3445	23.6555	255	81.3922	18.6078
156	70.7455	29.2545	206	76.4529	23.5471	256	81.4855	18.5145
157	70.8661	29.1339	207	76.5612	23.4388	257	81.5789	18.4211
158	70.9867	29.0133	208	76.6696	23.3304	258	81.6723	18.3277
159	71.1056	28.8944	209	76.7779	23.2221	259	81.7656	18.2344
160	71.2242	28.7758	210	76.8862	23.1138	260	81.8590	18.1410
161	71.3428	28.6572	211	76.9946	23.0054	261	81.9524	18.0476
162	71.4614	28.5386	212	77.0998	22.9002	262	82.0441	17.9559
163	71.5801	28.4199	213	77.2048	22.7952	263	82.1341	17.8659
164	71.6987	28.3013	214	77.3099	22.6901	264	82.2241	17.7759
165	71.8173	28.1827	215	77.4149	22.5851	265	82.3141	17.6859
166	71.9359	28.0641	216	77.5200	22.4800	266	82.4041	17.5959
167	72.0541	27.9459	217	77.6250	22.3750	267	82.4941	17.5059
168	72.1716	27.8284	218	77.7300	22.2700	268	82.5842	17.4158
169	72.2891	27.7109	219	77.8351	22.1649	269	82.6742	17.3258
170	72.4066	27.5934	220	77.9401	22.0599	270	82.7642	17.2358
171	72.5241	27.4759	221	78.0437	21.9563	271	82.8542	17.1458
172	72.6416	27.3584	222	78.1452	21.8548	272	82.9442	17.0558
173	72.7591	27.2409	223	78.2467	21.7533	273	83.0330	16.9670
174	72.8766	27.1234	224	78.3482	21.6518	274	83.1198	16.8802
175	72.9941	27.0059	225	78.4497	21.5503	275	83.2066	16.7934
176	73.1086	26.8914	226	78.5513	21.4487	276	83.2934	16.7066
177	73.2229	26.7771	227	78.6528	21.3472	277	83.3802	16.6198
178	73.3371	26.6629	228	78.7543	21.2457	278	83.4670	16.5330
179	73.4514	26.5486	229	78.8558	21.1442	279	83.5538	16.4462
180	73.5657	26.4343	230	78.9574	21.0426	280	83.6406	16.3594
181	73.6800	26.3200	231	79.0577	20.9423	281	83.7274	16.2726
182	73.7943	26.2057	232	79.1571	20.8429	282	83.8142	16.1858
183	73.9086	26.0914	233	79.2565	20.7435	283	83.9010	16.0990
184	74.0224	25.9776	234	79.3559	20.6441	284	83.9878	16.0122
185	74.1347	25.8653	235	79.4553	20.5447	285	84.0717	15.9283
186	74.2469	25.7531	236	79.5547	20.4453	286	84.1550	15.8450
187	74.3591	25.6409	237	79.6541	20.3459	287	84.2383	15.7617
188	74.4714	25.5286	238	79.7535	20.2465	288	84.3217	15.6783
189	74.5836	25.4164	239	79.8529	20.1471	289	84.4050	15.5950
190	74.6958	25.3042	240	79.9523	20.0477	290	84.4883	15.5117
191	74.8081	25.1919	241	80.0504	19.9496	291	84.5717	15.4283
192	74.9203	25.0797	242	80.1473	19.8527	292	84.6550	15.3450
193	75.0318	24.9682	243	80.2442	19.7558	293	84.7383	15.2617

294	84.8217	15.1783	346	88.7019	11.2981	398	91.8102	8.1898
295	84.9050	15.0950	347	88.7701	11.2299	399	91.8643	8.1357
296	84.9883	15.0117	348	88.8383	11.1617	400	91.9183	8.0817
297	85.0686	14.9314	349	88.9065	11.0935	401	91.9724	8.0276
298	85.1483	14.8517	350	88.9748	11.0252	402	92.0244	7.9756
299	85.2281	14.7719	351	89.0399	10.9601	403	92.0741	7.9259
300	85.3078	14.6922	352	89.1032	10.8968	404	92.1238	7.8762
301	85.3876	14.6124	353	89.1665	10.8335	405	92.1735	7.8265
302	85.4673	14.5327	354	89.2297	10.7703	406	92.2233	7.7767
303	85.5470	14.4530	355	89.2930	10.7070	407	92.2730	7.7270
304	85.6268	14.3732	356	89.3563	10.6437	408	92.3227	7.6773
305	85.7065	14.2935	357	89.4196	10.5804	409	92.3725	7.6275
306	85.7863	14.2137	358	89.4829	10.5171	410	92.4222	7.5778
307	85.8660	14.1340	359	89.5462	10.4538	411	92.4719	7.5281
308	85.9458	14.0542	360	89.6095	10.3905	412	92.5216	7.4784
309	86.0244	13.9756	361	89.6728	10.3272	413	92.5714	7.4286
310	86.1006	13.8994	362	89.7361	10.2639	414	92.6211	7.3789
311	86.1768	13.8232	363	89.7994	10.2006	415	92.6708	7.3292
312	86.2530	13.7470	364	89.8627	10.1373	416	92.7205	7.2795
313	86.3293	13.6707	365	89.9259	10.0741	417	92.7703	7.2297
314	86.4055	13.5945	366	89.9892	10.0108	418	92.8200	7.1800
315	86.4817	13.5183	367	90.0493	9.9507	419	92.8697	7.1303
316	86.5579	13.4421	368	90.1086	9.8914	420	92.9194	7.0806
317	86.6341	13.3659	369	90.1680	9.8320	421	92.9692	7.0308
318	86.7104	13.2896	370	90.2273	9.7727	422	93.0170	6.9830
319	86.7866	13.2134	371	90.2866	9.7134	423	93.0617	6.9383
320	86.8628	13.1372	372	90.3460	9.6540	424	93.1063	6.8937
321	86.9390	13.0610	373	90.4053	9.5947	425	93.1510	6.8490
322	87.0144	12.9856	374	90.4647	9.5353	426	93.1957	6.8043
323	87.0863	12.9137	375	90.5240	9.4760	427	93.2404	6.7596
324	87.1582	12.8418	376	90.5834	9.4166	428	93.2851	6.7149
325	87.2301	12.7699	377	90.6427	9.3573	429	93.3298	6.6702
326	87.3019	12.6981	378	90.7021	9.2979	430	93.3744	6.6256
327	87.3738	12.6262	379	90.7614	9.2386	431	93.4191	6.5809
328	87.4457	12.5543	380	90.8208	9.1792	432	93.4638	6.5362
329	87.5176	12.4824	381	90.8801	9.1199	433	93.5085	6.4915
330	87.5895	12.4105	382	90.9395	9.0605	434	93.5532	6.4468
331	87.6614	12.3386	383	90.9988	9.0012	435	93.5979	6.4021
332	87.7333	12.2667	384	91.0530	8.9470	436	93.6425	6.3575
333	87.8052	12.1948	385	91.1071	8.8929	437	93.6872	6.3128
334	87.8771	12.1229	386	91.1612	8.8388	438	93.7319	6.2681
335	87.9490	12.0510	387	91.2153	8.7847	439	93.7766	6.2234
336	88.0198	11.9802	388	91.2693	8.7307	440	93.8213	6.1787
337	88.0880	11.9120	389	91.3234	8.6766	441	93.8660	6.1340
338	88.1562	11.8438	390	91.3775	8.6225	442	93.9106	6.0894
339	88.2244	11.7756	391	91.4316	8.5684	443	93.9553	6.0447
340	88.2926	11.7074	392	91.4857	8.5143	444	94.0000	6.0000
341	88.3608	11.6392	393	91.5398	8.4602	445	94.0385	5.9615
342	88.4291	11.5709	394	91.5938	8.4062	446	94.0769	5.9231
343	88.4973	11.5027	395	91.6479	8.3521	447	94.1154	5.8846
344	88.5655	11.4345	396	91.7020	8.2980	448	94.1538	5.8462
345	88.6337	11.3663	397	91.7561	8.2439	449	94.1923	5.8077

450	94.2308	5.7692	500	95.9898	4.0102	550	97.2527	2.7473
451	94.2692	5.7308	501	96.0185	3.9815	551	97.2730	2.7270
452	94.3077	5.6923	502	96.0454	3.9546	552	97.2932	2.7068
453	94.3462	5.6538	503	96.0723	3.9277	553	97.3135	2.6865
454	94.3846	5.6154	504	96.0991	3.9009	554	97.3338	2.6662
455	94.4231	5.5769	505	96.1260	3.8740	555	97.3541	2.6459
456	94.4615	5.5385	506	96.1528	3.8472	556	97.3744	2.6256
457	94.5000	5.5000	507	96.1797	3.8203	557	97.3946	2.6054
458	94.5385	5.4615	508	96.2066	3.7934	558	97.4149	2.5851
459	94.5769	5.4231	509	96.2334	3.7666	559	97.4352	2.5648
460	94.6154	5.3846	510	96.2603	3.7397	560	97.4555	2.5445
461	94.6538	5.3462	511	96.2871	3.7129	561	97.4758	2.5242
462	94.6923	5.3077	512	96.3140	3.6860	562	97.4960	2.5040
463	94.7308	5.2692	513	96.3409	3.6591	563	97.5163	2.4837
464	94.7692	5.2308	514	96.3677	3.6323	564	97.5366	2.4634
465	94.8077	5.1923	515	96.3946	3.6054	565	97.5569	2.4431
466	94.8462	5.1538	516	96.4214	3.5786	566	97.5772	2.4228
467	94.8846	5.1154	517	96.4483	3.5517	567	97.5974	2.4026
468	94.9231	5.0769	518	96.4752	3.5248	568	97.6177	2.3823
469	94.9615	5.0385	519	96.5020	3.4980	569	97.6380	2.3620
470	95.0000	5.0000	520	96.5289	3.4711	570	97.6583	2.3417
471	95.0330	4.9670	521	96.5557	3.4443	571	97.6786	2.3214
472	95.0660	4.9340	522	96.5826	3.4174	572	97.6988	2.3012
473	95.0990	4.9010	523	96.6095	3.3905	573	97.7191	2.2809
474	95.1320	4.8680	524	96.6363	3.3637	574	97.7394	2.2606
475	95.1650	4.8350	525	96.6632	3.3368	575	97.7597	2.2403
476	95.1980	4.8020	526	96.6900	3.3100	576	97.7800	2.2200
477	95.2309	4.7691	527	96.7169	3.2831	577	97.8002	2.1998
478	95.2639	4.7361	528	96.7438	3.2562	578	97.8205	2.1795
479	95.2969	4.7031	529	96.7706	3.2294	579	97.8408	2.1592
480	95.3299	4.6701	530	96.7975	3.2025	580	97.8611	2.1389
481	95.3629	4.6371	531	96.8243	3.1757	581	97.8814	2.1186
482	95.3959	4.6041	532	96.8512	3.1488	582	97.9016	2.0984
483	95.4289	4.5711	533	96.8781	3.1219	583	97.9219	2.0781
484	95.4619	4.5381	534	96.9049	3.0951	584	97.9422	2.0578
485	95.4949	4.5051	535	96.9318	3.0682	585	97.9625	2.0375
486	95.5279	4.4721	536	96.9586	3.0414	586	97.9828	2.0172
487	95.5609	4.4391	537	96.9855	3.0145	587	98.0019	1.9981
488	95.5939	4.4061	538	97.0093	2.9907	588	98.0148	1.9852
489	95.6269	4.3731	539	97.0296	2.9704	589	98.0276	1.9724
490	95.6598	4.3402	540	97.0499	2.9501	590	98.0404	1.9596
491	95.6928	4.3072	541	97.0702	2.9298	591	98.0533	1.9467
492	95.7258	4.2742	542	97.0904	2.9096	592	98.0661	1.9339
493	95.7588	4.2412	543	97.1107	2.8893	593	98.0790	1.9210
494	95.7918	4.2082	544	97.1310	2.8690	594	98.0918	1.9082
495	95.8248	4.1752	545	97.1513	2.8487	595	98.1046	1.8954
496	95.8578	4.1422	546	97.1716	2.8284	596	98.1175	1.8825
497	95.8908	4.1092	547	97.1918	2.8082	597	98.1303	1.8697
498	95.9238	4.0762	548	97.2121	2.7879	598	98.1432	1.8568
499	95.9568	4.0432	549	97.2324	2.7676	599	98.1560	1.8440

600	98.1688	1.8312	652	98.8364	1.1636	704	99.1453	0.8547
601	98.1817	1.8183	653	98.8493	1.1507	705	99.1490	0.8510
602	98.1945	1.8055	654	98.8621	1.1379	706	99.1527	0.8473
603	98.2073	1.7927	655	98.8750	1.1250	707	99.1564	0.8436
604	98.2202	1.7798	656	98.8878	1.1122	708	99.1601	0.8399
605	98.2330	1.7670	657	98.9006	1.0994	709	99.1638	0.8362
606	98.2459	1.7541	658	98.9135	1.0865	710	99.1675	0.8325
607	98.2587	1.7413	659	98.9263	1.0737	711	99.1712	0.8288
608	98.2715	1.7285	660	98.9391	1.0609	712	99.1749	0.8251
609	98.2844	1.7156	661	98.9520	1.0480	713	99.1786	0.8214
610	98.2972	1.7028	662	98.9648	1.0352	714	99.1823	0.8177
611	98.3101	1.6899	663	98.9777	1.0223	715	99.1860	0.8140
612	98.3229	1.6771	664	98.9905	1.0095	716	99.1897	0.8103
613	98.3357	1.6643	665	99.0010	0.9990	717	99.1934	0.8066
614	98.3486	1.6514	666	99.0047	0.9953	718	99.1971	0.8029
615	98.3614	1.6386	667	99.0084	0.9916	719	99.2008	0.7992
616	98.3742	1.6258	668	99.0121	0.9879	720	99.2045	0.7955
617	98.3871	1.6129	669	99.0158	0.9842	721	99.2082	0.7918
618	98.3999	1.6001	670	99.0195	0.9805	722	99.2119	0.7881
619	98.4128	1.5872	671	99.0232	0.9768	723	99.2156	0.7844
620	98.4256	1.5744	672	99.0269	0.9731	724	99.2193	0.7807
621	98.4384	1.5616	673	99.0306	0.9694	725	99.2230	0.7770
622	98.4513	1.5487	674	99.0343	0.9657	726	99.2267	0.7733
623	98.4641	1.5359	675	99.0380	0.9620	727	99.2304	0.7696
624	98.4770	1.5230	676	99.0417	0.9583	728	99.2341	0.7659
625	98.4898	1.5102	677	99.0454	0.9546	729	99.2378	0.7622
626	98.5026	1.4974	678	99.0491	0.9509	730	99.2415	0.7585
627	98.5155	1.4845	679	99.0528	0.9472	731	99.2452	0.7548
628	98.5283	1.4717	680	99.0565	0.9435	732	99.2489	0.7511
629	98.5411	1.4589	681	99.0602	0.9398	733	99.2526	0.7474
630	98.5540	1.4460	682	99.0639	0.9361	734	99.2563	0.7437
631	98.5668	1.4332	683	99.0676	0.9324	735	99.2600	0.7400
632	98.5797	1.4203	684	99.0713	0.9287	736	99.2637	0.7363
633	98.5925	1.4075	685	99.0750	0.9250	737	99.2674	0.7326
634	98.6053	1.3947	686	99.0787	0.9213	738	99.2711	0.7289
635	98.6182	1.3818	687	99.0824	0.9176	739	99.2748	0.7252
636	98.6310	1.3690	688	99.0861	0.9139	740	99.2785	0.7215
637	98.6439	1.3561	689	99.0898	0.9102	741	99.2822	0.7178
638	98.6567	1.3433	690	99.0935	0.9065	742	99.2859	0.7141
639	98.6695	1.3305	691	99.0972	0.9028	743	99.2896	0.7104
640	98.6824	1.3176	692	99.1009	0.8991	744	99.2933	0.7067
641	98.6952	1.3048	693	99.1046	0.8954	745	99.2970	0.7030
642	98.7080	1.2920	694	99.1083	0.8917	746	99.3007	0.6993
643	98.7209	1.2791	695	99.1120	0.8880	747	99.3044	0.6956
644	98.7337	1.2663	696	99.1157	0.8843	748	99.3081	0.6919
645	98.7466	1.2534	697	99.1194	0.8806	749	99.3118	0.6882
646	98.7594	1.2406	698	99.1231	0.8769	750	99.3155	0.6845
647	98.7722	1.2278	699	99.1268	0.8732	751	99.3192	0.6808
648	98.7851	1.2149	700	99.1305	0.8695	752	99.3229	0.6771
649	98.7979	1.2021	701	99.1342	0.8658	753	99.3266	0.6734
650	98.8108	1.1892	702	99.1379	0.8621	754	99.3303	0.6697
651	98.8236	1.1764	703	99.1416	0.8584	755	99.3340	0.6660

756	99.3377	0.6623	806	99.5227	0.4773	856	99.7077	0.2923
757	99.3414	0.6586	807	99.5264	0.4736	857	99.7114	0.2886
758	99.3451	0.6549	808	99.5301	0.4699	858	99.7151	0.2849
759	99.3488	0.6512	809	99.5338	0.4662	859	99.7188	0.2812
760	99.3525	0.6475	810	99.5375	0.4625	860	99.7225	0.2775
761	99.3562	0.6438	811	99.5412	0.4588	861	99.7262	0.2738
762	99.3599	0.6401	812	99.5449	0.4551	862	99.7299	0.2701
763	99.3636	0.6364	813	99.5486	0.4514	863	99.7336	0.2664
764	99.3673	0.6327	814	99.5523	0.4477	864	99.7373	0.2627
765	99.3710	0.6290	815	99.5560	0.4440	865	99.7410	0.2590
766	99.3747	0.6253	816	99.5597	0.4403	866	99.7447	0.2553
767	99.3784	0.6216	817	99.5634	0.4366	867	99.7484	0.2516
768	99.3821	0.6179	818	99.5671	0.4329	868	99.7521	0.2479
769	99.3858	0.6142	819	99.5708	0.4292	869	99.7558	0.2442
770	99.3895	0.6105	820	99.5745	0.4255	870	99.7595	0.2405
771	99.3932	0.6068	821	99.5782	0.4218	871	99.7632	0.2368
772	99.3969	0.6031	822	99.5819	0.4181	872	99.7669	0.2331
773	99.4006	0.5994	823	99.5856	0.4144	873	99.7706	0.2294
774	99.4043	0.5957	824	99.5893	0.4107	874	99.7743	0.2257
775	99.4080	0.5920	825	99.5930	0.4070	875	99.7780	0.2220
776	99.4117	0.5883	826	99.5967	0.4033	876	99.7817	0.2183
777	99.4154	0.5846	827	99.6004	0.3996	877	99.7854	0.2146
778	99.4191	0.5809	828	99.6041	0.3959	878	99.7891	0.2109
779	99.4228	0.5772	829	99.6078	0.3922	879	99.7928	0.2072
780	99.4265	0.5735	830	99.6115	0.3885	880	99.7965	0.2035
781	99.4302	0.5698	831	99.6152	0.3848	881	99.8002	0.1998
782	99.4339	0.5661	832	99.6189	0.3811	882	99.8039	0.1961
783	99.4376	0.5624	833	99.6226	0.3774	883	99.8076	0.1924
784	99.4413	0.5587	834	99.6263	0.3737	884	99.8113	0.1887
785	99.4450	0.5550	835	99.6300	0.3700	885	99.8150	0.1850
786	99.4487	0.5513	836	99.6337	0.3663	886	99.8187	0.1813
787	99.4524	0.5476	837	99.6374	0.3626	887	99.8224	0.1776
788	99.4561	0.5439	838	99.6411	0.3589	888	99.8261	0.1739
789	99.4598	0.5402	839	99.6448	0.3552	889	99.8298	0.1702
790	99.4635	0.5365	840	99.6485	0.3515	890	99.8335	0.1665
791	99.4672	0.5328	841	99.6522	0.3478	891	99.8372	0.1628
792	99.4709	0.5291	842	99.6559	0.3441	892	99.8409	0.1591
793	99.4746	0.5254	843	99.6596	0.3404	893	99.8446	0.1554
794	99.4783	0.5217	844	99.6633	0.3367	894	99.8483	0.1517
795	99.4820	0.5180	845	99.6670	0.3330	895	99.8520	0.1480
796	99.4857	0.5143	846	99.6707	0.3293	896	99.8557	0.1443
797	99.4894	0.5106	847	99.6744	0.3256	897	99.8594	0.1406
798	99.4931	0.5069	848	99.6781	0.3219	898	99.8631	0.1369
799	99.4968	0.5032	849	99.6818	0.3182	899	99.8668	0.1332
800	99.5005	0.4995	850	99.6855	0.3145	900	99.8705	0.1295
801	99.5042	0.4958	851	99.6892	0.3108	901	99.8742	0.1258
802	99.5079	0.4921	852	99.6929	0.3071	902	99.8779	0.1221
803	99.5116	0.4884	853	99.6966	0.3034	903	99.8816	0.1184
804	99.5153	0.4847	854	99.7003	0.2997	904	99.8853	0.1147
805	99.5190	0.4810	855	99.7040	0.2960	905	99.8890	0.1110

906	99.8927	0.1073	917	99.9334	0.0666	928	99.9741	0.0259
907	99.8964	0.1036	918	99.9371	0.0629	929	99.9778	0.0222
908	99.9001	0.0999	919	99.9408	0.0592	930	99.9815	0.0185
909	99.9038	0.0962	920	99.9445	0.0555	931	99.9852	0.0148
910	99.9075	0.0925	921	99.9482	0.0518	932	99.9889	0.0111
911	99.9112	0.0888	922	99.9519	0.0481	933	99.9926	0.0074
912	99.9149	0.0851	923	99.9556	0.0444	934	99.9963	0.0037
913	99.9186	0.0814	924	99.9593	0.0407	935	100.0000	0.0000
914	99.9223	0.0777	925	99.9630	0.0370			
915	99.9260	0.0740	926	99.9667	0.0333			
916	99.9297	0.0703	927	99.9704	0.0296			