

## **Annex 9**

# **FMJD rating system and its application rules**

### **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. All games with time control minimum 30 minutes (1-hour total for both players) for the first 60 moves are countable for ratings. The development factor (see article 3.2.3) is:
  - (a) 100% (not reduced) for time control minimum 2-hours per player (4-hours total for both players) for the first 60 moves
  - (b) 60% for time control minimum 1-hour and 30 minutes per player (3-hours total for both players) for the first 60 moves.
  - (c) 40% for time control minimum 1-hour per player (2-hours total for both players) for the first 60 moves.
  - (d) 20% for time control minimum 30 minutes per player (1-hour total for both players) for the first 60 moves.
- 1.2.2.2. Games played as rapid – blitz or superblitz are counted for separate rating list “rapid-blitz”. These are the games with time control below 30 minutes (1-hour total for both players) for the first 60 moves. Development factor is:

- (a) 100% (not reduced) for time control maximum 15 minutes per player (30 minutes total for both players) for the first 60 moves
- (b) 50% for time control above 15 minutes but less than 30 minutes per player (above 30 minutes and less than 1-hour total for both players) for the first 60 moves.

1.2.2.3. General rules of annex 3 are used.

1.2.2.4. Rating service is free if results are delivered in the form defined at art. 4.

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 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 August 2019 the following formulas are valid

$$\text{FMJD} = 0,7443 * \text{Belgium} + 460,221 \quad \text{FMJD} = 0,5906 * \text{Netherlands} + 1385,095$$

$$\text{FMJD} = 0,4490 * \text{Poland} + 1016,326 \quad \text{FMJD} = 1,1693 * \text{FMJDblitz} - 347,58$$

## 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 (IX-1).

Interpolation formula. The interpolation formula for the rating difference  $D(P_r)$  belonging to non-integral percentages  $P_r$  is:

$$D(P_r) = D(P_1) + (P_r - P_1) [D(P_1+1) - D(P_1)] \dots \quad P_1 \text{ being the integral number of } P_r$$

[table IX-1] 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:

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

$P_1$  is the percentage for which  $D(P_1) \leq D(P_e) \leq D(P_1+1)$

$P_1$  being the integral number of  $P_r$

## 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

100 – 102,40

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

## 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:

$$R_p = R_c + D(P)$$

where:

$R_p$  is the performance rating

$R_c$  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 IX-1

Example:

Player rating = 2150, average opponents rating = 2050,

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

$$R_p = 2050 + 102,40 + (64,286 - 64) * (110,11 - 102,40) = 2050 + 104,6 = 2155$$

## 3.2. Calculation of the difference in rating

## 3.2.1. Calculation of the expected result

The expected result is calculated by the formula:

**2 \* number of games**

$$W_e = P_e * \frac{\quad}{100}$$

where  $P_e$  is the expected percentage based on the difference in rating between the player and the average rating of the opponents as given in table IX-2.

Example:

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

$P_e$  (from example 2.2.2) 63,6842%

$W_e = 63,6842 * 2 * 7 / 100 = 8,9158$

### 3.2.2. General formula

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

$$\Delta R = 0,5 * K (W - W_e)$$

where:

$\Delta R$  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.

$W_e$  is the expected result based on the rating difference

$K$  is the development factor

Example:

Player rating = 2150, average opponents rating = 2050,

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

$\Delta R = 0,5 * 15 * (9 - 8,9158) = 7,5 * 0,0842 = 0,6315$ ,

or  $\Delta R = 0,5 * 10 * (9 - 8,9158) = 0,421$ , ...

### 3.2.3. The development factor $K$

The development factor  $K$  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:

$$\mathbf{R_n = R_o + \Sigma \Delta R}$$

where:

$R_o$  is the old rating

$R_n$  is the new rating

$\Sigma \Delta R$  is the sum of the rating changes as calculated by the formulas given in art.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 art.3.1.1.  $R_p = R_c + D(P)$ .

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:

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

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. For reporting a tournament, the referee needs to use free official FMJD software (Draughts Arbiter PRO [DAP]). There is an icon with FMJD logo called “publishing tournament”. Then a short form should be filled. This is all to be done.

DAP is the only software to be used for World Championships and World Cups.

DAP has also the possibility to import data from a text file (definition at point 11), so this is support for the referee who is using another software tool.

For an official FMJD event like World Championship or officially recognised by FMJD like World Cup the main referee should send independently to FMJD office written report about tournament and assistant referees. This can be done also for any other event. This should be sent at [ratings@fmjd.org](mailto:ratings@fmjd.org).

The actual addresses should be checked on the FMJD web-site.

4.1.1. The report consists of:

- (a) Information about the competition:
- (b) information about the referee staff (names, contacts - specially emails, languages)
- (c) basic information about the competition (name, dates, place, sponsors, ...)
- (d) basic technical facts about the tournament (system, time control, etc.)
- (e) clear and full information about any special technical cases (winning games by referee decisions etc.)
- (f) any other remarks if necessary

4.2. Reporting tournament in other form.

The competition should be reported to the FMJD within 7 days after the last round. This should consist of report and results. Rating service for this form of report is not free.

4.2.1. The report consists of:

- (a) all information like at point 4.1.1.
- (b) confirmation of paying rating service

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. federation
- 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 to 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 factor 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. 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 additionally minimum 30 played in the 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 for 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 behavioural 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 Council 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 from 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  $R_p = R_c + D(P)$

Rc : Average rating of the opponents

- Rm : Average rating of the participants with  $R_u = 2100$  (2000 for the women) for players without rating (only for Annex 10),
- $\Delta R$  : 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 factor
- M : number of opponents
- Rn : New rating
- Ro : Original rating before the start of a tournament
- $\sum \Delta R$  : Sum of the rating changes
- $R_u$  : 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.

## 11. FMJD official format for tournament data

General remark – use only standard letters like in English alphabet – also any comments etc in English only.

<section Info>

name = text with tournament name maximum length c(30)

played from = DD/MM/YYYY

played to = DD/MM/YYYY

type = possible value here: SWISS, ROUND, TEAMS, OTHER

national championship = Y/N Y-only in case when it is FINAL of National Championship

women championship = Y/N

name of referee = text - maximum length c(25)

place = text with tournament place maximum length c(30)

country = c(3) code (see general remarks about country code) of country

remarks = <remark> free text – not limited </end remark>

winner = text - maximum length c(25) (name of player or team)

</end info>

<section players>

each line contains info about one player in the following form:

fmjd-ID, players number in tournament, local ID, place, points, first name, last name, country, born, sex

example:

11285,7,124,3,12,jacek,pawlicki,pl,02/01/1960,M

comments:

generally – number of comas should be always the same (!) – 9 even some of fields are empty

fmjd-ID – clear n(5) – if no then 0 (zero)

tournament number – n(3) OBLIGATORY

local ID – local ID number c(6) – if no then empty

place – n(3) place in tournament, if team competition, place of team, if individual competition then each number unique !!!, if tournament not finish yet (for example report from part of the season in Dutch NC) then 0 for all

points – n(3) amount of points – OBLIGATORY (very important for general control)

first name – c(17)

last name – c(17)

country – c(3) code of country – see general remark below

born – DD/MM/YYYY obligatory for Youth and veteran competitions

sex – W/M – clear not necessary to fulfil when fmjd-ID exist

</end players>

<section results>

each line contains result of ONE game:

round, tournament number player with white, tournament number of second player, result

example:

1,1,22,2-0

comments:

All fields obligatory

Tournaments numbers – according 2nd field in “Section players”

If pause game (against dummy) – then player number = 0

Results possible:

2-0, 0-2, 1-1

if results based on referee decision then we mark it as follow:

2x0, 0x2, 1x1, or 0x0

</end results>

Country code according to fmjd database - codes based on ISO:

<http://www.iso.org/iso/en/prods-services/iso3166ma/02iso-3166-code-lists/list-en1.html>

**[table IX-2]** 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	53	57.3601	42.6399	106	64.4669	35.5331
1	50.1401	49.8599	54	57.4986	42.5014	107	64.5966	35.4034
2	50.2801	49.7199	55	57.6371	42.3629	108	64.7263	35.2737
3	50.4202	49.5798	56	57.7756	42.2244	109	64.8560	35.1440
4	50.5602	49.4398	57	57.9141	42.0859	110	64.9857	35.0143
5	50.7003	49.2997	58	58.0517	41.9483	111	65.1154	34.8846
6	50.8403	49.1597	59	58.1878	41.8122	112	65.2451	34.7549
7	50.9804	49.0196	60	58.3238	41.6762	113	65.3748	34.6252
8	51.1194	48.8806	61	58.4599	41.5401	114	65.5045	34.4955
9	51.2583	48.7417	62	58.5959	41.4041	115	65.6342	34.3658
10	51.3972	48.6028	63	58.7320	41.2680	116	65.7639	34.2361
11	51.5361	48.4639	64	58.8680	41.1320	117	65.8936	34.1064
12	51.6750	48.3250	65	59.0041	40.9959	118	66.0228	33.9772
13	51.8139	48.1861	66	59.1392	40.8608	119	66.1496	33.8504
14	51.9528	48.0472	67	59.2743	40.7257	120	66.2763	33.7237
15	52.0924	47.9076	68	59.4095	40.5905	121	66.4030	33.5970
16	52.2325	47.7675	69	59.5446	40.4554	122	66.5298	33.4702
17	52.3725	47.6275	70	59.6797	40.3203	123	66.6565	33.3435
18	52.5126	47.4874	71	59.8149	40.1851	124	66.7833	33.2167
19	52.6527	47.3473	72	59.9500	40.0500	125	66.9100	33.0900
20	52.7927	47.2073	73	60.0851	39.9149	126	67.0367	32.9633
21	52.9328	47.0672	74	60.2203	39.7797	127	67.1631	32.8369
22	53.0719	46.9281	75	60.3554	39.6446	128	67.2895	32.7105
23	53.2102	46.7898	76	60.4905	39.5095	129	67.4159	32.5841
24	53.3485	46.6515	77	60.6257	39.3743	130	67.5424	32.4576
25	53.4869	46.5131	78	60.7608	39.2392	131	67.6688	32.3312
26	53.6252	46.3748	79	60.8959	39.1041	132	67.7952	32.2048
27	53.7635	46.2365	80	61.0306	38.9694	133	67.9216	32.0784
28	53.9018	46.0982	81	61.1638	38.8362	134	68.0473	31.9527
29	54.0435	45.9565	82	61.2969	38.7031	135	68.1719	31.8281
30	54.1934	45.8066	83	61.4301	38.5699	136	68.2964	31.7036
31	54.3433	45.6567	84	61.5632	38.4368	137	68.4209	31.5791
32	54.4933	45.5067	85	61.6964	38.3036	138	68.5455	31.4545
33	54.6432	45.3568	86	61.8296	38.1704	139	68.6700	31.3300
34	54.7931	45.2069	87	61.9627	38.0373	140	68.7945	31.2055
35	54.9430	45.0570	88	62.0957	37.9043	141	68.9191	31.0809
36	55.0799	44.9201	89	62.2287	37.7713	142	69.0428	30.9572
37	55.2088	44.7912	90	62.3617	37.6383	143	69.1652	30.8348
38	55.3376	44.6624	91	62.4947	37.5053	144	69.2876	30.7124
39	55.4665	44.5335	92	62.6277	37.3723	145	69.4100	30.5900
40	55.5954	44.4046	93	62.7606	37.2394	146	69.5324	30.4676
41	55.7242	44.2758	94	62.8936	37.1064	147	69.6548	30.3452
42	55.8531	44.1469	95	63.0263	36.9737	148	69.7772	30.2228
43	55.9820	44.0180	96	63.1579	36.8421	149	69.8996	30.1004
44	56.1185	43.8815	97	63.2895	36.7105	150	70.0217	29.9783
45	56.2562	43.7438	98	63.4211	36.5789	151	70.1423	29.8577
46	56.3939	43.6061	99	63.5526	36.4474	152	70.2630	29.7370
47	56.5317	43.4683	100	63.6842	36.3158	153	70.3836	29.6164
48	56.6694	43.3306	101	63.8158	36.1842	154	70.5042	29.4958
49	56.8072	43.1928	102	63.9474	36.0526	155	70.6248	29.3752
50	56.9449	43.0551	103	64.0778	35.9222	156	70.7455	29.2545
51	57.0831	42.9169	104	64.2075	35.7925	157	70.8661	29.1339
52	57.2216	42.7784	105	64.3372	35.6628	158	70.9867	29.0133

159	71.1056	28.8944	216	77.5200	22.4800	273	83.0330	16.9670
160	71.2242	28.7758	217	77.6250	22.3750	274	83.1198	16.8802
161	71.3428	28.6572	218	77.7300	22.2700	275	83.2066	16.7934
162	71.4614	28.5386	219	77.8351	22.1649	276	83.2934	16.7066
163	71.5801	28.4199	220	77.9401	22.0599	277	83.3802	16.6198
164	71.6987	28.3013	221	78.0437	21.9563	278	83.4670	16.5330
165	71.8173	28.1827	222	78.1452	21.8548	279	83.5538	16.4462
166	71.9359	28.0641	223	78.2467	21.7533	280	83.6406	16.3594
167	72.0541	27.9459	224	78.3482	21.6518	281	83.7274	16.2726
168	72.1716	27.8284	225	78.4497	21.5503	282	83.8142	16.1858
169	72.2891	27.7109	226	78.5513	21.4487	283	83.9010	16.0990
170	72.4066	27.5934	227	78.6528	21.3472	284	83.9878	16.0122
171	72.5241	27.4759	228	78.7543	21.2457	285	84.0717	15.9283
172	72.6416	27.3584	229	78.8558	21.1442	286	84.1550	15.8450
173	72.7591	27.2409	230	78.9574	21.0426	287	84.2383	15.7617
174	72.8766	27.1234	231	79.0577	20.9423	288	84.3217	15.6783
175	72.9941	27.0059	232	79.1571	20.8429	289	84.4050	15.5950
176	73.1086	26.8914	233	79.2565	20.7435	290	84.4883	15.5117
177	73.2229	26.7771	234	79.3559	20.6441	291	84.5717	15.4283
178	73.3371	26.6629	235	79.4553	20.5447	292	84.6550	15.3450
179	73.4514	26.5486	236	79.5547	20.4453	293	84.7383	15.2617
180	73.5657	26.4343	237	79.6541	20.3459	294	84.8217	15.1783
181	73.6800	26.3200	238	79.7535	20.2465	295	84.9050	15.0950
182	73.7943	26.2057	239	79.8529	20.1471	296	84.9883	15.0117
183	73.9086	26.0914	240	79.9523	20.0477	297	85.0686	14.9314
184	74.0224	25.9776	241	80.0504	19.9496	298	85.1483	14.8517
185	74.1347	25.8653	242	80.1473	19.8527	299	85.2281	14.7719
186	74.2469	25.7531	243	80.2442	19.7558	300	85.3078	14.6922
187	74.3591	25.6409	244	80.3411	19.6589	301	85.3876	14.6124
188	74.4714	25.5286	245	80.4380	19.5620	302	85.4673	14.5327
189	74.5836	25.4164	246	80.5349	19.4651	303	85.5470	14.4530
190	74.6958	25.3042	247	80.6318	19.3682	304	85.6268	14.3732
191	74.8081	25.1919	248	80.7287	19.2713	305	85.7065	14.2935
192	74.9203	25.0797	249	80.8256	19.1744	306	85.7863	14.2137
193	75.0318	24.9682	250	80.9225	19.0775	307	85.8660	14.1340
194	75.1416	24.8584	251	81.0187	18.9813	308	85.9458	14.0542
195	75.2514	24.7486	252	81.1120	18.8880	309	86.0244	13.9756
196	75.3611	24.6389	253	81.2054	18.7946	310	86.1006	13.8994
197	75.4709	24.5291	254	81.2988	18.7012	311	86.1768	13.8232
198	75.5807	24.4193	255	81.3922	18.6078	312	86.2530	13.7470
199	75.6905	24.3095	256	81.4855	18.5145	313	86.3293	13.6707
200	75.8002	24.1998	257	81.5789	18.4211	314	86.4055	13.5945
201	75.9100	24.0900	258	81.6723	18.3277	315	86.4817	13.5183
202	76.0195	23.9805	259	81.7656	18.2344	316	86.5579	13.4421
203	76.1278	23.8722	260	81.8590	18.1410	317	86.6341	13.3659
204	76.2362	23.7638	261	81.9524	18.0476	318	86.7104	13.2896
205	76.3445	23.6555	262	82.0441	17.9559	319	86.7866	13.2134
206	76.4529	23.5471	263	82.1341	17.8659	320	86.8628	13.1372
207	76.5612	23.4388	264	82.2241	17.7759	321	86.9390	13.0610
208	76.6696	23.3304	265	82.3141	17.6859	322	87.0144	12.9856
209	76.7779	23.2221	266	82.4041	17.5959	323	87.0863	12.9137
210	76.8862	23.1138	267	82.4941	17.5059	324	87.1582	12.8418
211	76.9946	23.0054	268	82.5842	17.4158	325	87.2301	12.7699
212	77.0998	22.9002	269	82.6742	17.3258	326	87.3019	12.6981
213	77.2048	22.7952	270	82.7642	17.2358	327	87.3738	12.6262
214	77.3099	22.6901	271	82.8542	17.1458	328	87.4457	12.5543
215	77.4149	22.5851	272	82.9442	17.0558	329	87.5176	12.4824



330	87.5895	12.4105	387	91.2153	8.7847	444	94.0000	6.0000
331	87.6614	12.3386	388	91.2693	8.7307	445	94.0385	5.9615
332	87.7333	12.2667	389	91.3234	8.6766	446	94.0769	5.9231
333	87.8052	12.1948	390	91.3775	8.6225	447	94.1154	5.8846
334	87.8771	12.1229	391	91.4316	8.5684	448	94.1538	5.8462
335	87.9490	12.0510	392	91.4857	8.5143	449	94.1923	5.8077
336	88.0198	11.9802	393	91.5398	8.4602	450	94.2308	5.7692
337	88.0880	11.9120	394	91.5938	8.4062	451	94.2692	5.7308
338	88.1562	11.8438	395	91.6479	8.3521	452	94.3077	5.6923
339	88.2244	11.7756	396	91.7020	8.2980	453	94.3462	5.6538
340	88.2926	11.7074	397	91.7561	8.2439	454	94.3846	5.6154
341	88.3608	11.6392	398	91.8102	8.1898	455	94.4231	5.5769
342	88.4291	11.5709	399	91.8643	8.1357	456	94.4615	5.5385
343	88.4973	11.5027	400	91.9183	8.0817	457	94.5000	5.5000
344	88.5655	11.4345	401	91.9724	8.0276	458	94.5385	5.4615
345	88.6337	11.3663	402	92.0244	7.9756	459	94.5769	5.4231
346	88.7019	11.2981	403	92.0741	7.9259	460	94.6154	5.3846
347	88.7701	11.2299	404	92.1238	7.8762	461	94.6538	5.3462
348	88.8383	11.1617	405	92.1735	7.8265	462	94.6923	5.3077
349	88.9065	11.0935	406	92.2233	7.7767	463	94.7308	5.2692
350	88.9748	11.0252	407	92.2730	7.7270	464	94.7692	5.2308
351	89.0399	10.9601	408	92.3227	7.6773	465	94.8077	5.1923
352	89.1032	10.8968	409	92.3725	7.6275	466	94.8462	5.1538
353	89.1665	10.8335	410	92.4222	7.5778	467	94.8846	5.1154
354	89.2297	10.7703	411	92.4719	7.5281	468	94.9231	5.0769
355	89.2930	10.7070	412	92.5216	7.4784	469	94.9615	5.0385
356	89.3563	10.6437	413	92.5714	7.4286	470	95.0000	5.0000
357	89.4196	10.5804	414	92.6211	7.3789	471	95.0330	4.9670
358	89.4829	10.5171	415	92.6708	7.3292	472	95.0660	4.9340
359	89.5462	10.4538	416	92.7205	7.2795	473	95.0990	4.9010
360	89.6095	10.3905	417	92.7703	7.2297	474	95.1320	4.8680
361	89.6728	10.3272	418	92.8200	7.1800	475	95.1650	4.8350
362	89.7361	10.2639	419	92.8697	7.1303	476	95.1980	4.8020
363	89.7994	10.2006	420	92.9194	7.0806	477	95.2309	4.7691
364	89.8627	10.1373	421	92.9692	7.0308	478	95.2639	4.7361
365	89.9259	10.0741	422	93.0170	6.9830	479	95.2969	4.7031
366	89.9892	10.0108	423	93.0617	6.9383	480	95.3299	4.6701
367	90.0493	9.9507	424	93.1063	6.8937	481	95.3629	4.6371
368	90.1086	9.8914	425	93.1510	6.8490	482	95.3959	4.6041
369	90.1680	9.8320	426	93.1957	6.8043	483	95.4289	4.5711
370	90.2273	9.7727	427	93.2404	6.7596	484	95.4619	4.5381
371	90.2866	9.7134	428	93.2851	6.7149	485	95.4949	4.5051
372	90.3460	9.6540	429	93.3298	6.6702	486	95.5279	4.4721
373	90.4053	9.5947	430	93.3744	6.6256	487	95.5609	4.4391
374	90.4647	9.5353	431	93.4191	6.5809	488	95.5939	4.4061
375	90.5240	9.4760	432	93.4638	6.5362	489	95.6269	4.3731
376	90.5834	9.4166	433	93.5085	6.4915	490	95.6598	4.3402
377	90.6427	9.3573	434	93.5532	6.4468	491	95.6928	4.3072
378	90.7021	9.2979	435	93.5979	6.4021	492	95.7258	4.2742
379	90.7614	9.2386	436	93.6425	6.3575	493	95.7588	4.2412
380	90.8208	9.1792	437	93.6872	6.3128	494	95.7918	4.2082
381	90.8801	9.1199	438	93.7319	6.2681	495	95.8248	4.1752
382	90.9395	9.0605	439	93.7766	6.2234	496	95.8578	4.1422
383	90.9988	9.0012	440	93.8213	6.1787	497	95.8908	4.1092
384	91.0530	8.9470	441	93.8660	6.1340	498	95.9238	4.0762
385	91.1071	8.8929	442	93.9106	6.0894	499	95.9568	4.0432
386	91.1612	8.8388	443	93.9553	6.0447	500	95.9898	4.0102



501	96.0185	3.9815	558	97.4149	2.5851	615	98.3614	1.6386
502	96.0454	3.9546	559	97.4352	2.5648	616	98.3742	1.6258
503	96.0723	3.9277	560	97.4555	2.5445	617	98.3871	1.6129
504	96.0991	3.9009	561	97.4758	2.5242	618	98.3999	1.6001
505	96.1260	3.8740	562	97.4960	2.5040	619	98.4128	1.5872
506	96.1528	3.8472	563	97.5163	2.4837	620	98.4256	1.5744
507	96.1797	3.8203	564	97.5366	2.4634	621	98.4384	1.5616
508	96.2066	3.7934	565	97.5569	2.4431	622	98.4513	1.5487
509	96.2334	3.7666	566	97.5772	2.4228	623	98.4641	1.5359
510	96.2603	3.7397	567	97.5974	2.4026	624	98.4770	1.5230
511	96.2871	3.7129	568	97.6177	2.3823	625	98.4898	1.5102
512	96.3140	3.6860	569	97.6380	2.3620	626	98.5026	1.4974
513	96.3409	3.6591	570	97.6583	2.3417	627	98.5155	1.4845
514	96.3677	3.6323	571	97.6786	2.3214	628	98.5283	1.4717
515	96.3946	3.6054	572	97.6988	2.3012	629	98.5411	1.4589
516	96.4214	3.5786	573	97.7191	2.2809	630	98.5540	1.4460
517	96.4483	3.5517	574	97.7394	2.2606	631	98.5668	1.4332
518	96.4752	3.5248	575	97.7597	2.2403	632	98.5797	1.4203
519	96.5020	3.4980	576	97.7800	2.2200	633	98.5925	1.4075
520	96.5289	3.4711	577	97.8002	2.1998	634	98.6053	1.3947
521	96.5557	3.4443	578	97.8205	2.1795	635	98.6182	1.3818
522	96.5826	3.4174	579	97.8408	2.1592	636	98.6310	1.3690
523	96.6095	3.3905	580	97.8611	2.1389	637	98.6439	1.3561
524	96.6363	3.3637	581	97.8814	2.1186	638	98.6567	1.3433
525	96.6632	3.3368	582	97.9016	2.0984	639	98.6695	1.3305
526	96.6900	3.3100	583	97.9219	2.0781	640	98.6824	1.3176
527	96.7169	3.2831	584	97.9422	2.0578	641	98.6952	1.3048
528	96.7438	3.2562	585	97.9625	2.0375	642	98.7080	1.2920
529	96.7706	3.2294	586	97.9828	2.0172	643	98.7209	1.2791
530	96.7975	3.2025	587	98.0019	1.9981	644	98.7337	1.2663
531	96.8243	3.1757	588	98.0148	1.9852	645	98.7466	1.2534
532	96.8512	3.1488	589	98.0276	1.9724	646	98.7594	1.2406
533	96.8781	3.1219	590	98.0404	1.9596	647	98.7722	1.2278
534	96.9049	3.0951	591	98.0533	1.9467	648	98.7851	1.2149
535	96.9318	3.0682	592	98.0661	1.9339	649	98.7979	1.2021
536	96.9586	3.0414	593	98.0790	1.9210	650	98.8108	1.1892
537	96.9855	3.0145	594	98.0918	1.9082	651	98.8236	1.1764
538	97.0093	2.9907	595	98.1046	1.8954	652	98.8364	1.1636
539	97.0296	2.9704	596	98.1175	1.8825	653	98.8493	1.1507
540	97.0499	2.9501	597	98.1303	1.8697	654	98.8621	1.1379
541	97.0702	2.9298	598	98.1432	1.8568	655	98.8750	1.1250
542	97.0904	2.9096	599	98.1560	1.8440	656	98.8878	1.1122
543	97.1107	2.8893	600	98.1688	1.8312	657	98.9006	1.0994
544	97.1310	2.8690	601	98.1817	1.8183	658	98.9135	1.0865
545	97.1513	2.8487	602	98.1945	1.8055	659	98.9263	1.0737
546	97.1716	2.8284	603	98.2073	1.7927	660	98.9391	1.0609
547	97.1918	2.8082	604	98.2202	1.7798	661	98.9520	1.0480
548	97.2121	2.7879	605	98.2330	1.7670	662	98.9648	1.0352
549	97.2324	2.7676	606	98.2459	1.7541	663	98.9777	1.0223
550	97.2527	2.7473	607	98.2587	1.7413	664	98.9905	1.0095
551	97.2730	2.7270	608	98.2715	1.7285	665	99.0010	0.9990
552	97.2932	2.7068	609	98.2844	1.7156	666	99.0047	0.9953
553	97.3135	2.6865	610	98.2972	1.7028	667	99.0084	0.9916
554	97.3338	2.6662	611	98.3101	1.6899	668	99.0121	0.9879
555	97.3541	2.6459	612	98.3229	1.6771	669	99.0158	0.9842
556	97.3744	2.6256	613	98.3357	1.6643	670	99.0195	0.9805
557	97.3946	2.6054	614	98.3486	1.6514	671	99.0232	0.9768

672	99.0269	0.9731	729	99.2378	0.7622	786	99.4487	0.5513
673	99.0306	0.9694	730	99.2415	0.7585	787	99.4524	0.5476
674	99.0343	0.9657	731	99.2452	0.7548	788	99.4561	0.5439
675	99.0380	0.9620	732	99.2489	0.7511	789	99.4598	0.5402
676	99.0417	0.9583	733	99.2526	0.7474	790	99.4635	0.5365
677	99.0454	0.9546	734	99.2563	0.7437	791	99.4672	0.5328
678	99.0491	0.9509	735	99.2600	0.7400	792	99.4709	0.5291
679	99.0528	0.9472	736	99.2637	0.7363	793	99.4746	0.5254
680	99.0565	0.9435	737	99.2674	0.7326	794	99.4783	0.5217
681	99.0602	0.9398	738	99.2711	0.7289	795	99.4820	0.5180
682	99.0639	0.9361	739	99.2748	0.7252	796	99.4857	0.5143
683	99.0676	0.9324	740	99.2785	0.7215	797	99.4894	0.5106
684	99.0713	0.9287	741	99.2822	0.7178	798	99.4931	0.5069
685	99.0750	0.9250	742	99.2859	0.7141	799	99.4968	0.5032
686	99.0787	0.9213	743	99.2896	0.7104	800	99.5005	0.4995
687	99.0824	0.9176	744	99.2933	0.7067	801	99.5042	0.4958
688	99.0861	0.9139	745	99.2970	0.7030	802	99.5079	0.4921
689	99.0898	0.9102	746	99.3007	0.6993	803	99.5116	0.4884
690	99.0935	0.9065	747	99.3044	0.6956	804	99.5153	0.4847
691	99.0972	0.9028	748	99.3081	0.6919	805	99.5190	0.4810
692	99.1009	0.8991	749	99.3118	0.6882	806	99.5227	0.4773
693	99.1046	0.8954	750	99.3155	0.6845	807	99.5264	0.4736
694	99.1083	0.8917	751	99.3192	0.6808	808	99.5301	0.4699
695	99.1120	0.8880	752	99.3229	0.6771	809	99.5338	0.4662
696	99.1157	0.8843	753	99.3266	0.6734	810	99.5375	0.4625
697	99.1194	0.8806	754	99.3303	0.6697	811	99.5412	0.4588
698	99.1231	0.8769	755	99.3340	0.6660	812	99.5449	0.4551
699	99.1268	0.8732	756	99.3377	0.6623	813	99.5486	0.4514
700	99.1305	0.8695	757	99.3414	0.6586	814	99.5523	0.4477
701	99.1342	0.8658	758	99.3451	0.6549	815	99.5560	0.4440
702	99.1379	0.8621	759	99.3488	0.6512	816	99.5597	0.4403
703	99.1416	0.8584	760	99.3525	0.6475	817	99.5634	0.4366
704	99.1453	0.8547	761	99.3562	0.6438	818	99.5671	0.4329
705	99.1490	0.8510	762	99.3599	0.6401	819	99.5708	0.4292
706	99.1527	0.8473	763	99.3636	0.6364	820	99.5745	0.4255
707	99.1564	0.8436	764	99.3673	0.6327	821	99.5782	0.4218
708	99.1601	0.8399	765	99.3710	0.6290	822	99.5819	0.4181
709	99.1638	0.8362	766	99.3747	0.6253	823	99.5856	0.4144
710	99.1675	0.8325	767	99.3784	0.6216	824	99.5893	0.4107
711	99.1712	0.8288	768	99.3821	0.6179	825	99.5930	0.4070
712	99.1749	0.8251	769	99.3858	0.6142	826	99.5967	0.4033
713	99.1786	0.8214	770	99.3895	0.6105	827	99.6004	0.3996
714	99.1823	0.8177	771	99.3932	0.6068	828	99.6041	0.3959
715	99.1860	0.8140	772	99.3969	0.6031	829	99.6078	0.3922
716	99.1897	0.8103	773	99.4006	0.5994	830	99.6115	0.3885
717	99.1934	0.8066	774	99.4043	0.5957	831	99.6152	0.3848
718	99.1971	0.8029	775	99.4080	0.5920	832	99.6189	0.3811
719	99.2008	0.7992	776	99.4117	0.5883	833	99.6226	0.3774
720	99.2045	0.7955	777	99.4154	0.5846	834	99.6263	0.3737
721	99.2082	0.7918	778	99.4191	0.5809	835	99.6300	0.3700
722	99.2119	0.7881	779	99.4228	0.5772	836	99.6337	0.3663
723	99.2156	0.7844	780	99.4265	0.5735	837	99.6374	0.3626
724	99.2193	0.7807	781	99.4302	0.5698	838	99.6411	0.3589
725	99.2230	0.7770	782	99.4339	0.5661	839	99.6448	0.3552
726	99.2267	0.7733	783	99.4376	0.5624	840	99.6485	0.3515
727	99.2304	0.7696	784	99.4413	0.5587	841	99.6522	0.3478
728	99.2341	0.7659	785	99.4450	0.5550	842	99.6559	0.3441

843	99.6596	0.3404	874	99.7743	0.2257	905	99.8890	0.1110
844	99.6633	0.3367	875	99.7780	0.2220	906	99.8927	0.1073
845	99.6670	0.3330	876	99.7817	0.2183	907	99.8964	0.1036
846	99.6707	0.3293	877	99.7854	0.2146	908	99.9001	0.0999
847	99.6744	0.3256	878	99.7891	0.2109	909	99.9038	0.0962
848	99.6781	0.3219	879	99.7928	0.2072	910	99.9075	0.0925
849	99.6818	0.3182	880	99.7965	0.2035	911	99.9112	0.0888
850	99.6855	0.3145	881	99.8002	0.1998	912	99.9149	0.0851
851	99.6892	0.3108	882	99.8039	0.1961	913	99.9186	0.0814
852	99.6929	0.3071	883	99.8076	0.1924	914	99.9223	0.0777
853	99.6966	0.3034	884	99.8113	0.1887	915	99.9260	0.0740
854	99.7003	0.2997	885	99.8150	0.1850	916	99.9297	0.0703
855	99.7040	0.2960	886	99.8187	0.1813	917	99.9334	0.0666
856	99.7077	0.2923	887	99.8224	0.1776	918	99.9371	0.0629
857	99.7114	0.2886	888	99.8261	0.1739	919	99.9408	0.0592
858	99.7151	0.2849	889	99.8298	0.1702	920	99.9445	0.0555
859	99.7188	0.2812	890	99.8335	0.1665	921	99.9482	0.0518
860	99.7225	0.2775	891	99.8372	0.1628	922	99.9519	0.0481
861	99.7262	0.2738	892	99.8409	0.1591	923	99.9556	0.0444
862	99.7299	0.2701	893	99.8446	0.1554	924	99.9593	0.0407
863	99.7336	0.2664	894	99.8483	0.1517	925	99.9630	0.0370
864	99.7373	0.2627	895	99.8520	0.1480	926	99.9667	0.0333
865	99.7410	0.2590	896	99.8557	0.1443	927	99.9704	0.0296
866	99.7447	0.2553	897	99.8594	0.1406	928	99.9741	0.0259
867	99.7484	0.2516	898	99.8631	0.1369	929	99.9778	0.0222
868	99.7521	0.2479	899	99.8668	0.1332	930	99.9815	0.0185
869	99.7558	0.2442	900	99.8705	0.1295	931	99.9852	0.0148
870	99.7595	0.2405	901	99.8742	0.1258	932	99.9889	0.0111
871	99.7632	0.2368	902	99.8779	0.1221	933	99.9926	0.0074
872	99.7669	0.2331	903	99.8816	0.1184	934	99.9963	0.0037
873	99.7706	0.2294	904	99.8853	0.1147	935	100.0000	0.0000