

Guideline on the exchange and use of EPS verification results

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1. Introduction

World Meteorological Organization (WMO) CBS-XIII (2005) recommended that the general responsibilities for a Lead Centre for Verification of EPS be added to *the Manual on the WMO Integrated Processing and Prediction System (WIPPS) (WMO-No.485)*¹ and that the President designate RSMC Tokyo (Japan Meteorological Agency; JMA) as the Lead Centre.

JMA hosts two Internet sites for the Lead Centre works; a Web site and a FTP site. The FTP site is used for EPS producing centres to upload their statistics of EPS verification and the Web site is used to publish them. The Internet sites enable EPS producers to make their own statistics of EPS verification open to the WMO Members. The Internet sites also enable the WMO Members to obtain not only the statistics but also their visualized images.

This guideline is organized as follows. Section 2 describes definitions of the EPS verification. Section 3 describes how to record and read the statistics on the Internet sites for EPS producers and the WMO Members, respectively. Section 4 describes the rule of the report, and section 5 describes how to obtain the EPS verification scores. Section 6 describes how to post the statistics on the FTP site only for EPS producers.

2. Definition of standard EPS verification

It is defined at *the Appendix 2.2.35 of the Manual on the WIPPS* (See Appendix A) that standard verification of an EPS are exchanged monthly to measure the forecast skill of ensemble mean, spread, continuous ranked probability score (CRPS) and probability with respect to the analysis and/or climatology. The factors and definitions of the measure are also explained in Table 1.

There are many ways of constructing an EPS and the CBS Expert Team on Operational Weather and Forecasting Process and Support made it clear that the intention is to verify the complete system as used operationally, and in the way in which the producing centre would advise its users to use the EPS. Where time-lagged or multi-model ensemble combinations are used, the full ensemble should be verified as used operationally. For example, if a producing centre recommends combining ensemble members from two or more cycles of its ensemble

¹ Available at <https://library.wmo.int/idurl/4/35703>

to form a larger time-lagged ensemble, then it is this larger time-lagged ensemble which should be verified (rather than the latest cycle alone). (Note, nevertheless, that it is the raw ensemble which should be verified and not any post-processed or calibrated output.)

3. The statistics of EPS verification

3.1 The verification table of ensemble mean and spread

The verification table, called the deterministic table here, is defined as follows: A header line, which starts with “#”, should be put at the head of the deterministic table. The header line should consist of 5 elements as follows:

```
# <EPS centre name> <Element> <Year> <Month> <Area>
```

where <term> indicates a keyword which is listed up in Table 2.

The first, second, third, fourth and fifth column of the table following the header line indicates the number, forecast time, anomaly correlation coefficient of the ensemble mean, root-mean-square (RMS) error of the ensemble mean and spread (standard deviation), respectively.

Some spaces, at least one, are necessary among each column as a separator.

A comment line, which starts with “!”, can be put anywhere.

3.2 Reliability table

The table is complied with Standardized Verification System (SVS) for long-range forecasts (LRF), as indicated on the web-site of the Lead Centre for the Long Range Forecast Verification System². The table is quoted as Table 3, below.

A header line, which starts with “#”, should be put at the head of the reliability table. The header line should consist of 7 or 8 elements as follows:

```
# <EPS centre name> <Element> <Threshold> <Year> <Month> <Area>  
<Forecast time> <Proxy (PR24 only)>
```

where <term> indicates a keyword which is listed up in Table 2. The eighth element, <Proxy (PR24 only)>, is not used for elements except for the verification of precipitation.

The first, second, third, fourth and fifth column of the table following the header

² <http://www.bom.gov.au/wmo/lrfvs/roc.shtml>

line indicates the bin number, the number of members forecasting occurrence of the event, the number of members forecasting non occurrence of the event, observed occurrences and observed non-occurrences, respectively.

Some spaces, at least one, are necessary among each column as a separator.

A comment line, which starts with “!”, can be put anywhere.

3.3 The verification table of continuous rank probability score (CRPS)

The verification table, called the CRPS table here, is defined as follows: A header line, which starts with “#”, should be put at the head of the CRPS table. The header line should consist of 5 or 6 elements as follows;

```
# <EPS centre name> <Element> <Year> <Month> <Area> <Proxy (PR24 only)>
```

where <term> indicates a keyword which is listed up in Table2. The sixth element, <Proxy (PR24 only)>, is not used for elements except for the verification of precipitation.

The first, second, third and fourth column of the table following the header line indicates the number, forecast time, CRPS for EPS forecast distribution, CRPS for the control forecast in EPS, respectively. CRPS for deterministic forecast is equal to the mean absolute error. If CRPS for the control forecast in EPS is not being reported, the fourth column has to be set “-1” instead.

Some spaces, at least one, are necessary among each column as a separator.

A comment line, which starts with “!”, can be put anywhere.

4. Rule of the report on the verification table

The reliability table, the CRPS table and the deterministic table should include verification results only for one EPS reported with an ascii file(s)(See Appendix B, C and D). The file name of the verification table should comply with the following rule;

- in case of reporting verification results for own EPS,

```
<Reporting centre name>_<Classification>_<Year><Month>.txt
```

- otherwise,

```
<Reporting centre name>_<Classification>_<Year><Month>.txt.for_<EPS centre name>
```

where <term> indicates a keyword which is listed up in Table 2.

If EPS producer would like to add and/or update the verification table after reporting it, she/he has to overwrite it using the same file name.

5. Climatology

The climatology data used in the verification measures are available from the ftp server of the WMO Lead Centre for Deterministic Forecast Verification³.

6. Stations list for verification of precipitation against observations

Verification of precipitation is recommended to be performed against observations, which are based on the GCOS list of surface networks (GSN). The latest GSN stations list is available from the OSCAR/Surface website⁴. You can get the list in JSON format by accessing the following URL:

<https://oscar.wmo.int/surface/rest/api/search/station?programAffiliation=GSN>

EPS producing centres shall have the right to omit certain observation sites if these fail a quality control.

Verification of precipitation may alternatively be against a proxy analysis. For more details, please refer to *the Manual on the WIPPS* (See Appendix A).

7. How to get the verification table

JMA operates a Web site for both exchanging the statistics and publishing them. The name and address of the Web site are EPSV and <https://epsv.kishou.go.jp/EPsv/>, respectively.

8. How to post the verification table

JMA operates a FTP site which is used for EPS producers to report their statistics of EPS verification. The name and address of the ftp site are FTPEPSV and <ftp://ftpepsv.kishou.go.jp>, respectively.

8.1 Registration

The ftp site is allowed to access only from the registered site. The EPS

³ For more details, please see <https://wmoledn.ecmwf.int/>.

⁴ <https://oscar.wmo.int/surface/index.html>

producer should notify the administrator (globalnwp@met.kishou.go.jp) of the global IP address(es) (for example, 11.22.33.44) of her/his own site.

JMA will send the EPS producer the login information of FTPEPSV, such as user name, at least in one month after the notification.

8.2 Post

The EPS producer is able to login FTPEPSV with the user name and the password provided. She/He put the monthly verification table on her/his home directory of FTPEPSV.

The verification table is available by accessing EPSV (see section 7) in a day after they are put on FTPEPSV. And, old date verification tables on FTPEPSV may be deleted due to the limitation of disk resources.

Table 1: Factors and definitions used in the EPS verification

Ensemble mean	$\tilde{F}_i = \frac{1}{m} \sum_{j=1}^m F_{i,j}$
Spread (Standard Deviation)	$\sqrt{\frac{1}{m} \sum_{j=1}^m (F_{i,j} - \tilde{F}_i)^2}$
Root Mean Square Error	$\sqrt{\overline{e_i^2}}$
Mean Absolute Error	$\overline{ e_i }$
Anomaly Correlation Coefficient	$\frac{\sum_{i=1}^n (f_i - \bar{f}_i) (a_i - \bar{a}_i) \cos \varphi_i}{\sqrt{\sum_{i=1}^n (f_i - \bar{f}_i)^2 \cos^2 \varphi_i \cdot \sum_{i=1}^n (a_i - \bar{a}_i)^2 \cos^2 \varphi_i}}$
Brier Score	$\overline{(P_i - O_i)^2}$
Continuous Rank Probability Score	$\int_{-\infty}^{\infty} [\hat{P}_i(x) - \hat{O}_i(x)]^2 dx \quad \dagger$

where F_i : forecast value, A_i : corresponding verifying value,

C_i : corresponding climatological value,

P_i : probability, O_i : {observed:1, or not-observed:0},

m : the ensemble size,

n : the number of grid points in the verification area,

$\cos \varphi_i$: cosine of latitude of grid point i

$$e_i = F_i - A_i, \quad f_i = F_i - C_i, \quad a_i = A_i - C_i,$$

$$\hat{P}_i(x) = \frac{1}{m} \sum_{j=1}^m H(x - F_{i,j}), \quad \hat{O}_i(x) = H(x - A_i),$$

$$H(x) = \begin{cases} 0 & (x < 0) \\ 1 & (x \geq 0) \end{cases},$$

$$\bar{X}_i = \frac{\sum_{i=1}^n X_i \cos \varphi_i}{\sum_{i=1}^n \cos \varphi_i}.$$

[†] E.g. H. Hersbach, 2000: Decomposition of the continuous ranked probability score for ensemble prediction systems. *Wea. Forecasting*, **15**, 559-570

Table 2 : List of keywords

Element	Keyword (Bold)			
<Reporting centre name>	BOM,CMA,CMC,CPTEC,DWD,ECMWF,JMA,KMA,MF,NC EP,NCMRWF,RUMS,UKMO		Abbreviation of reporting centre	
<EPS centre name>	BOM,CMA,CMC,CPTEC,DWD,ECMWF,JMA,KMA,MF,NC EP,NCMRWF,RUMS,UKMO		Abbreviation of EPS producer	
<Classification>	RELTBL , ACCERRSPD or CRPS	RELTBL	The reliability table	
		ACCERRSPD	The scores of ensemble mean forecast and the spread	
		CRPS	The continuous rank probability scores of ensemble forecast and deterministic forecast	
<Element >	Z500anm T850anm PMSLanm TSFCanm Z500 T850 PMSL W850 U850 V850 U250 V250 PR24 TSFC WSFC	Z500anm	Anomaly for 500hPa geopotential height (unit:m)	
		T850anm	Anomaly for 850hPa temperature (unit:K)	
		PMSLanm	Anomaly for mean sea-level pressure (unit:hPa)	
		TSFCanm	Anomaly for 2-metre temperature (unit:K)	
		Z500	500hPa geopotential height (unit:m)	
		T850	850hPa temperature (unit:K)	
		PMSL	Mean sea-level pressure (unit:hPa)	
		W850	850hPa wind speed (unit:m/s)	
		U(V)850	850hPa u(v) wind component (unit:m/s)	
		U(V)250	250hPa u(v) wind component (unit:m/s)	
		PR24	24-hour accumulated precipitation (unit:mm)	
		TSFC	2-metre temperature (unit:K)	
		WSFC	10-metre wind speed (unit:m/s)	
		<Threshold>	Z500anm, T850anm, PMSLanm or TSFCanm	gt1sd,gt1.5sd,gt2sd,lt-1sd,lt-1.5sd or lt-2sd
lt	Abbreviation of 'less than'			
sd	Abbreviation of 'Standard deviation'			

	W850	gt10mps,gt15mps or gt25mps	mps	Abbreviation of 'm/s'
	WSFC	gt10mps or gt15mps		
	U850, V850, U250 or V250	gt10P, gt25P,gt75P or gt 90P	P	Abbreviation of 'percentile point of climatological chance (%)'
	PR24	gt1mm,gt5mm, gt10mm or gt25mm	mm	Unit of precipitation
<Year>	2003, 2004, ...		(Numeric) Target year	
<Month>	01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11 or 12		(Numeric) Target month	
<Area>	NH, SH or TR		NH	Northern Hemisphere extra-tropics (20N-90N)
			SH	Southern Hemisphere extra-tropics (20S-90S)
			TR	Tropics (20S-20N)
<Forecast time>	24, 48, 72, 96, 120, ...		(Numeric) forecast time (unit:hour)	
<Proxy (PR24 only)>	PROXY or blank		This keyword is used when the verification of precipitation is performed against a proxy analysis. Otherwise, leave this field blank.	

Table 3: The definition of reliability table (Source: Lead Centre for the Long-Range Forecast Verification System)

General ROC contingency table for probabilistic forecasts of binary events with definitions of the different parameters. This contingency table applies when probability thresholds are used to define the different probability bins

<i>Bin number</i>	<i>Forecast probabilities</i>	<i>Observed occurrences</i>	<i>Observed non-occurrences</i>
1	0-P ₂ (%)	O ₁	NO ₁
2	P ₂ -P ₃ (%)	O ₂	NO ₂
3	P ₃ -P ₄ (%)	O ₃	NO ₃
...
n	P _n -P _{n+1} (%)	O _n	NO _n
...
N	P _N -100 (%)	O _N	NO _N

where,

n = number of the nth probability interval or bin n; n goes from 1 to N.

P_n = lower probability limit for bin n.

P_{n+1} = upper probability limit for bin n.

N = number of probability intervals or bins.

$$O_n = \sum W_i (O)_i$$

(O) being 1 when an event corresponding to a forecast in bin n, is observed as an occurrence; 0 otherwise. The summation is over all forecasts in bin n, at all grid points i or stations i.

$$NO_n = \sum W_i (NO)_i$$

(NO) being 1 when an event corresponding to a forecast in bin n, is not observed; 0 otherwise. The summation is over all forecasts in bin n, at all grid points i or stations i.

W_i = 1 when verification is done at stations or single grid points; W_i = cos(Θ_i) at grid-point i, when verification is done on a grid; Θ_i the latitude at grid point i.

Appendix A : The standard verification measures of EPS (Source: *the Appendix 2.2.35 of the Manual of the WIPPS (2023 edition)*)

APPENDIX 2.2.35. STANDARD VERIFICATION MEASURES OF THE GLOBAL ENSEMBLE PREDICTION SYSTEM

1. Introduction

This appendix presents detailed procedures for the production and exchange of a standard set of verification scores for EPS forecasts produced by WIPPS centres. The goal is to provide consistent verification information on the EPS products of WIPPS-participating centres for forecasters in NMHSs and to help the WIPPS centres compare and improve their forecasts. Scores will be exchanged between the participating Producing Centres via the Lead Centre(s) for EPS verification. The Lead Centre functions, as described in 2.2.3.2, include creating and maintaining a website for EPS verification information so that potential users will benefit from a consistent presentation of the results.

The Ensemble Prediction System provides a complete estimation of the forecast probability distribution, including a best-estimate deterministic forecast from the ensemble mean, as well as measures of forecast uncertainty and probabilities. Verification of the EPS therefore includes verification of the ensemble mean as a deterministic NWP forecast following the guidance set out in Appendix 2.2.34 as well as specific measures of the probabilistic performance.

The standardized verification should provide key relevant information appropriate to the state of the art in EPS, while being as simple and easy to implement as possible, and ensuring a consistent implementation across participating centres, in particular in the interpolation to the verification grid, and use of a common climatology and set of observations.

2. Verification statistics

Four sets of verification statistics are defined below. **A mandatory set shall be provided by all participating centres.** The detailed procedures are required to ensure it is possible to compare results from the different participating centres in a scientifically valid manner.

A set of additional recommended statistics is also defined that all centres should provide if possible.

The four sets of statistics are summarized as:

- **A mandatory set shall be provided by all participating centres:**
 - **Ensemble mean;**
 - **Spread – standard deviation of the ensemble averaged over the same regions and variables as used for the ensemble mean;**
 - **Continuous ranked probability score (CRPS);**
- Additional recommended:
 - Probability scores – scores for probabilities of specific thresholds are exchanged in the form of reliability tables. Several different scores are computed by the Lead Centres based on the reliability tables provided by participating centres.

Specifications of forecast verification set out in the paragraphs below apply to calculation of the CRPS and other probability scores. Verification of the ensemble mean and spread should follow the specifications set out in Appendix 2.2.34, as stated above.

3. **Parameters**

Root mean square error and correlation coefficient between forecast and analysis anomalies of ensemble mean shall be calculated for the following set of parameters:

- MSLP;
- 500-hPa geopotential height;
- u and v wind components at 850 and 250 hPa;
- 850-hPa temperature.

Spread shall be calculated for the same set of parameters for ensemble mean.

Reliability tables for the calculation of probability scores shall be calculated for the following set of parameters and thresholds:

- MSLP anomalies ± 1 , ± 1.5 and ± 2 standard deviation with respect to the defined climatology;
- 500-hPa geopotential height anomalies with thresholds ± 1 , ± 1.5 and ± 2 standard deviation with respect to the defined climatology;
- 850-hPa wind speed with thresholds of 10, 15 and 25 m s^{-1} ;
- 850-hPa u and v wind components with thresholds of 10th, 25th, 75th and 90th percentile points with respect to the defined climatology;
- 250-hPa u and v wind components with thresholds of 10th, 25th, 75th and 90th percentile points with respect to the defined climatology;
- 850-hPa temperature anomalies with thresholds ± 1 , ± 1.5 and ± 2 standard deviation with respect to the defined climatology;
- Precipitation with thresholds 1, 5, 10 and 25 mm/24 hours;
- 10-metre wind speed with thresholds 10 and 15 m s^{-1} ;
- 2-metre temperature anomalies with thresholds ± 1 , ± 1.5 and ± 2 standard deviation with respect to the defined climatology.

Note: Where thresholds are defined with respect to climatology, the defined climatology is set out in paragraph 11 below.

The CRPS shall be calculated for the same set of parameters for probability score.

4. **Forecast times**

Scores shall be computed daily for forecasts initialized at times to be specified by the centre, but shall include all forecast cycles made available on WIS.

5. **Forecast steps**

Forecast steps shall be every 24 hours to the end of the forecast range.

6. **Areas**

Northern hemisphere extra-tropics	90°N–20°N, inclusive, all longitudes
Southern hemisphere extra-tropics	90°S–20°S, inclusive, all longitudes
Tropics	20°N–20°S, inclusive, all longitudes

Verification against analyses should be performed for grid points within each area, including points on the boundary.

7. **Verification against analyses**

7.1 **Grid and interpolation**

All parameters except precipitation shall be verified against the centre's own analysis on a regular 1.5° × 1.5° grid.

In selecting the verification grid, consideration has been given to the variety of resolutions of current global NWP models, the resolved scales of models (several grid lengths), the resolution of the available climatologies, the potential to monitor long-term trends in performance (including earlier, lower-resolution forecasts) and computational efficiency.

Interpolation of higher-resolution model fields to the verification grid shall be performed to retain features at the scale of the verification grid but not to introduce any additional smoothing. The following procedures shall be used:

- **Spectral fields: Truncate to equivalent spectral resolution (T120) for verification grid;**
- **Grid-point fields: Use area-weighting to interpolate to verification grid.**

For scores requiring a climatology the climatology is specified in paragraph 11 below.

Verification of precipitation is recommended to be performed against observations (see paragraph 8), but may alternatively be against a proxy analysis (that is, a short-range forecast from the control, or a high-resolution deterministic forecast, for example, 12–36-hour forecast to avoid spin-up problems).

8. **Verification against observations**

8.1 **Observations**

Observations for EPS verification of precipitation shall be based on the GCOS list of surface networks. Producing Centres shall have the right to omit certain observation sites if these fail a quality control.

8.2 **Interpolation**

Verification shall be made using the nearest native model grid point to the observation location.

8.3 **Areas**

The networks used in verification against observations consist of observation stations located in the areas listed in section 6.

9. **Scores**

Root mean square error and correlation coefficient between forecast and analysis anomalies are to be calculated for all parameters by the participating centres and provided to the Lead Centre(s) in the form specified on the Lead Centre(s) website(s).

The following scores are to be calculated for all parameters (computed by the Lead Centre(s) based on reliability tables provided by participating centres):

- Brier skill score (with respect to climatology);
- ROC;
- Relative economic value (C/L) diagrams;
- Reliability diagrams with frequency distribution.

The CRPS is to be calculated for all parameters by the participating centres and provided to the Lead Centre(s) in the format specified on the Lead Centre(s) website(s). Centres are encouraged to submit CRPS scores for both EPS and the deterministic (control and high-resolution) forecast – CRPS for deterministic forecast is equal to the mean absolute error.

10. **Exchange of scores**

Each centre shall provide scores monthly to the Lead Centre(s). Details of the procedure and the required format for the data are provided on the Lead Centre(s) website(s). **All scores for all forecasts verifying within a month shall be provided as soon as possible after the end of that month.**

11. **Climatology**

To ensure consistency between results from different centres a common climatology shall be used for those scores requiring a climatology. All centres shall use the climatology provided via the Lead Centre(s) website(s), which is the same climatology specified in Appendix 2.2.34 and available from the Lead Centre(s) for DNV website(s).

A daily climatology of upper-air parameters are available for both 00 UTC and 12 UTC. This provides an up-to-date estimate of climate characteristics for each day of the year, including climate mean, standard deviation and selected quantiles of the climate distribution. These latter statistics are required for the INFCOM standardized verification of EPS forecasts.

The data are made available in GRIB format. Information on access to the data and further documentation are provided on the Lead Centre(s) for DNV website(s).

12. **Documentation**

Participating centres shall provide to the Lead Centre(s) information on their implementation of the standardized verification system annually, shall confirm to the Lead Centre(s) any changes to its implementation (including the annual change of station list, changes in additional statistics) and changes in their NWP model.

Appendix B : A sample of the content of a deterministic table

--- start ---

JMA PMSL 2003 10 NH

1 24 0.977 1.727 2.126

2 48 0.944 2.673 2.929

3 72 0.892 3.659 3.791

4 96 0.829 4.566 4.673

5 120 0.755 5.374 5.482

6 144 0.681 6.024 6.179

7 168 0.606 6.552 6.697

8 192 0.523 7.040 7.029

9 216 0.446 7.405 7.316

! comment

JMA T850 2003 10 NH

1 24 0.969 1.032 1.104

2 48 0.936 1.477 1.493

3 72 0.893 1.893 1.907

4 96 0.840 2.283 2.338

5 120 0.774 2.671 2.726

6 144 0.705 3.008 3.054

7 168 0.634 3.293 3.295

8 192 0.567 3.509 3.451

9 216 0.506 3.676 3.563

--- end ---

Appendix C : A sample of the content of a reliability table

--- start ---

JMA PMSLanm gt1.5sd 2003 10 NH 24

1 0 25 22.05 55781.09
2 1 24 22.3 2227.46
3 2 23 26.95 1167.75
4 3 22 30.56 728.55
5 4 21 29.36 567.3
6 5 20 30.33 453.26
7 6 19 28.95 371.56
8 7 18 36.06 314.66
9 8 17 32.78 242.68
10 9 16 34.58 228.72
11 10 15 49.14 216.17
12 11 14 50.52 206
13 12 13 55.21 166.8
14 13 12 54.14 124.92
15 14 11 64.04 133.85
16 15 10 70.51 97.28
17 16 9 83.12 80.33
18 17 8 77.79 72.42
19 18 7 84.46 68.86
20 19 6 118.51 54.69
21 20 5 110.96 58.49
22 21 4 149.15 54.08
23 22 3 178.97 56.57
24 23 2 223.6 55.37
25 24 1 304.71 42.21
26 25 0 1706.48 57.91

JMA PMSLanm gt1.5sd 2003 10 NH 48

1 0 25 44.16 53376.69
2 1 24 53.03 2873.91
3 2 23 49.89 1417.19
4 3 22 35.38 960.68
5 4 21 35.32 703.11

6 5 20 43.64 581.41
7 6 19 46.73 469.66
8 7 18 52.89 424.78
9 8 17 45.92 350.8
10 9 16 44.21 336.88
11 10 15 59.71 272.31
12 11 14 63.77 230.68
13 12 13 74.05 208.44
14 13 12 67.93 206.62
15 14 11 80.56 181.75
16 15 10 89.66 165.36
17 16 9 105.09 133.48
18 17 8 109.73 135.43
19 18 7 122.6 109.76
20 19 6 125.97 110.21
21 20 5 160.89 82.79
22 21 4 187.03 81.05
23 22 3 242.3 75.05
24 23 2 258.44 51.92
25 24 1 378.68 47.92
26 25 0 1097.7 41.37
--- end ---

Appendix D : A sample of the content of a CRPS table

```
--- start ---  
# JMA Z500 2009 01 NH  
1 24 5.328 7.095  
2 48 9.639 13.141  
3 72 14.797 20.579  
4 96 20.439 28.571  
5 120 26.131 36.681  
6 144 31.698 44.742  
7 168 36.586 51.677  
8 192 40.981 57.883  
9 216 44.582 63.157  
!comment  
# JMA Z500 2009 01 SH  
1 24 4.657 -1  
2 48 8.545 -1  
3 72 12.980 -1  
4 96 17.446 -1  
5 120 22.148 -1  
6 144 26.941 -1  
7 168 31.453 -1  
8 192 35.108 -1  
9 216 37.920 -1  
--- end ---
```