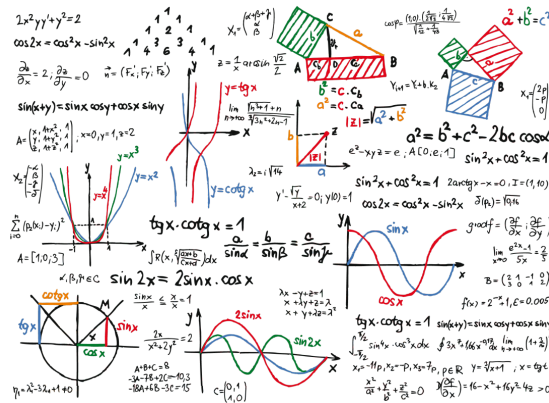


B4 - Mathematics

B-MAT-400

208dowels

Quality control, calibration and χ



208dowels

binary name: 208dowels

language: everything working on "the dump"

compilation: when necessary, via Makefile, including re, clean and fclean rules



- The totality of your source files, except all useless files (binary, temp files, obj files,...), must be included in your delivery.
- All the bonus files (including a potential specific Makefile) should be in a directory named *bonus*.
- Error messages have to be written on the error output, and the program should then exit with the 84 error code (0 if there is no error).

A power hammer mass produces dowels. Sometimes, some pieces are defective, and the whole process requires quality control: 100 samples of 100 pieces are randomly taken, and defective pieces are numbered. We get what we call an observed serial. Then, a statistical fit is done using the binomial distribution, and validated using the χ^2 test.

Let's note x the number of defective pieces, O_x the size of the observed sample, and T_x the theoretical size. To ensure the consistency of the fit, statistical classes which have less than 10 elements are merged until there are only classes with 10 or more elements. Smallest classes are aggregated first.

Finally, with the number of constraints for the fit being 2, the degrees of freedom parameter ν is equal to the number of classes minus 2.

Your program will take 9 integers as inputs, representing respectively O_0, O_1, \dots, O_{8+} and will output:

1. an array showing observed and theoretical sizes for each statistical class (with totals)
2. the chosen probability distribution for the fit,
3. the value of χ^2 ,
4. the value of ν ,
5. the value range in which the probability falls if the fit is valid.



USAGE

```
Terminal
~/B-MAT-400> ./208dowels -h
USAGE
  ./208dowels 00 01 02 03 04 05 06 07 08

DESCRIPTION
  0i    size of the observed class
```

EXAMPLES

```
Terminal
~/B-MAT-400> ./208dowels 6 4 10 18 20 19 11 5 7
  x   | 0-1 | 2   | 3   | 4   | 5   | 6   | 7+  | Total
  Ox  | 10  | 10  | 18  | 20  | 19  | 11  | 12  | 100
  Tx  | 8.0 | 13.8| 19.2| 19.9| 16.3| 11.1| 11.7| 100
Distribution:      B(100, 0.0410)
Chi-squared:       2.029
Degrees of freedom: 5
Fit validity:       80% < P < 90%
```

```
Terminal
~/B-MAT-400> ./208dowels 6 4 10 8 20 19 11 5 17
  x   | 0-1 | 2-3 | 4   | 5   | 6-7 | 8+  | Total
  Ox  | 10  | 18  | 20  | 19  | 16  | 17  | 100
  Tx  | 5.2 | 26.7| 19.1| 17.7| 22.2| 9.0 | 100
Distribution:      B(100, 0.0460)
Chi-squared:       16.119
Degrees of freedom: 4
Fit validity:       P < 1%
```

```
Terminal
~/B-MAT-400> ./208dowels 4 5 13 19 20 16 12 7 4
  x   | 0-2 | 3   | 4   | 5   | 6   | 7+  | Total
  Ox  | 22  | 19  | 20  | 16  | 12  | 11  | 100
  Tx  | 23.1| 19.7| 19.9| 16.0| 10.6| 10.7| 100
Distribution:      B(100, 0.0401)
Chi-squared:       0.270
Degrees of freedom: 4
Fit validity:       P > 99%
```

χ^2 DISTRIBUTION TABLE

ν	99%	90%	80%	70%	60%	50%	40%	30%	20%	10%	5%	2%	1%
1	0.000	0.020	0.060	0.15	0.27	0.45	0.71	1.07	1.64	2.71	3.84	5.41	6.63
2	0.020	0.21	0.45	0.71	1.02	1.39	1.83	2.41	3.22	4.61	5.99	7.82	9.21
3	0.11	0.58	1.01	1.42	1.87	2.37	2.95	3.66	4.64	6.25	7.81	9.84	11.34
4	0.30	1.06	1.65	2.19	2.75	3.36	4.04	4.88	5.99	7.78	9.49	11.67	13.28
5	0.55	1.61	2.34	3.00	3.66	4.35	5.13	6.06	7.29	9.24	11.07	13.39	15.09
6	0.87	2.20	3.07	3.83	4.57	5.35	6.21	7.23	8.56	10.64	12.59	15.03	16.81
7	1.24	2.83	3.82	4.67	5.49	6.35	7.28	8.38	9.80	12.02	14.07	16.62	18.48
8	1.65	3.49	4.59	5.53	6.42	7.34	8.35	9.52	11.03	13.36	15.51	18.17	20.09
9	2.09	4.17	5.38	6.39	7.36	8.34	9.41	10.66	12.24	14.68	16.92	19.68	21.67
10	2.56	4.87	6.18	7.27	8.30	9.34	10.47	11.78	13.44	15.99	18.31	21.16	23.21