



INTERNATIONAL ATOMIC ENERGY AGENCY  
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION



**INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS**  
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CABLE: CENTRATOM - TELEX 460392-1

SMR/107 - 15

WORKSHOP ON PATTERN RECOGNITION AND ANALYSIS OF SEISMICITY

(5 - 16 December 1983)

E X E R C I S E S

on the computer terminal

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These are preliminary lecture notes, intended only for distribution to participants.  
Missing copies are available from Room 230.



## COMMON NOTATIONS

1. To switch on/off the terminal push the switch on the back side of it.  
Red light on the keyboard indicates "ON".
2. If the terminal is ON but the screen is dark, push **[CAPS LOCK]**.
3. **TSM>\_** always means the request of the system for instruction. Similar request has a program, for example **DIS>\_** is the **DISTR.X** request.
4. **ENTER CR FOR MORE** means that not all output is flashed. Punch **[CR]** for continuation of the output.

**WARNING :** if you punch anything else in response your job will be aborted and you have to start again.

## GENERAL OPERATIONS

PURPOSE	WHAT TO PUNCH	THE LAST LINE FLASHED
To begin the work	<b>[ESC]</b> (your code) <b>[CR]</b> <b>[CR]</b>	- ENTER YOUR OWNERNAME:_ - <b>TSM&gt;_</b>
To check the list of files	<b>LOG [CR]</b> or <b>CAT [CR]</b>	ENTER RETURN FOR MORE:_ or <b>TSM&gt;_</b>
To delete a file	<b>D (name of file) [CR]</b>	<b>TSM&gt;_</b>
To start a program	<b>GO (name) [CR]</b>	###>_ (### are the first three letters of the programs' name)
To interrupt a running job	<b>[ESC]</b> (DO NOT PUNCH <b>[CR]</b> )	(CONTINUE, ABORT, DEBUG OR HOLD):_
to continue	<b>C</b>	
to abort	<b>A</b>	
To end the work	<b>X [CR]</b>	RING IN FOR SERVICE_ switch off the terminal

## CHARACTERISTICS OF THE CATALOG AND THE DIAGNOSTICS OF PARTITION B

NECESSARY FILES  
(in any order)  
**SUBCAT.X** - the program SUBCAT  
**DISTR.X** - the program DISTR  
**APT.X** - the program APT  
**AFTSIL** - silence file for **APT.X**  
**CAPAS.D** - the catalog for S-W Pacific: I900-I980,  
 $(-12 \leq \varphi \leq 0 ; 130 \leq \lambda \leq 160)$  from  
 USGS-NOAA world's catalog

The result of each exercise is a table. Call it on the screen (type).

It should be the same as the similar Table in this instructions.

Print nothing until all exercises are done.

I. For the catalog **CAPAS.D** generate Table I - the distribution of the number of epicentres on the map. Use **DISTR** without any initial silence file.

No linear transformations of magnitudes. Common magnitude MC is the maximal of MB, MS, MP, ML.

I900-I980, no limitations on magnitude ( $0 \leq MC \leq 9$ ),  $-12 \leq \varphi \leq 0$ ,  
 $134 \leq \lambda \leq 155$ , no limitations on depth.

Non-overlapping intervals (interval = shift):  $2^\circ$  in longitude and  $0.5^\circ$  in latitude.

Store silence file under the name **DSWP**.

For the same catalog generate Table 2 - the distribution of the maximal value of MC on the map. All parameters are the same as in Table I. Use **DISTR** and the silence file **DSWP**.

through I900-I980,

Ia. Generate subcatalog from the **CAPAS.D**  $(-10 \leq \varphi \leq 0, 134 \leq \lambda \leq 147$ , focal depth  $\leq 100$  km. Use **SUBCAT**. No initial silence file.

Processing of the magnitudes is the same as in exercise I.

Store this subcatalog under the name **SICTP**. Silence file will be automatically stored under the name **SICTP**.

You will check the result in the next two exercises.

II. For the catalog CICTP (see exercise I), generate file I - the list of all earthquakes with  $MC \geq 7$ . Use the program SUBCAT and the silence file SICTP.

III. For the catalog DICTP generate Table 4 - the distribution of MC for each year through 1930-1980. Processing of magnitudes is the same as in the exercise I. Non-overlapping magnitude intervals: interval = shift = I.

Use DISTR and the silence file DSWP.

IV. For the catalog CICTP generate Table 5 - the list of the main shocks with statistics of aftershocks. Use program AFT and silence file A without changing it. Just understand the answers.

Repeat computations; do not type sigma but count aftershocks in two more time-intervals: 7 days and 30 days (Table 6).

\* \* \* \*

If you still have some time, you may try now any computations for another region which you are interested in. Ask the teacher for the access to the world's catalog.

### Answers to the written exercises

Your username is

In your directory there are following files :

P.R. programs (see P.R. guide)

COIN.X

COD.X

COR.X

HAM.X

Data for intersections of morphostructural lineaments in California according to [I]:

COCLF.D - silence file (parameters of coding)

ORCLF.D - information on parameters

RACLF.D - binary codes of parameters

KACLF.D - silence file (parameters for the algorithm Cora)

Assign I, 2 and 3 to the classes D, N and X respectively.

I. Feed in initial data (Table in the Answers to written exercise III); use COIN.

To check yourself follow the correct sequence of actions :

TSM>GO COIN ; COI>y ; OREX ; I5 ; n ; 2 ; n ; r ; nl [n is forbidden] ; n ; I ; 0,2 ; n ; e.t.c. to correct the value of some parameter for the object punch the name of this parameter I5 ; 0,3 ; n ; n [no corrections]; n [do not want to print] ; TSM>

Now in OREX file you have the values of parameters.

II. Code parameters from OREX. Use program COD and no initial silence file. The class for each object is given in the answer to the written exercise II. Subclasses: (I, 2), (7, 8, 10), (I3, I4). Create the silence file KAEX and file RAEX with binary codes of data.

To check yourself follow the correct sequence of actions :

the  
TSM>GO COD ; COD>OREX ; 3 ; / ; I ; e.t.c. [class according to answer to exercise II] ... 3 ; n [for any correction punch the name of object to be corrected] ; y ; 3 ; / ; 2 ; / ; I ; 2 ; n ; 7 [example of error: there are 3 objects in the 2 subclass] ; 3 ; / ; 7 ; 8 ; 9 [example of error: object 9 is in the 2 class] ; I3 ; y [you have to change subclass] ; / ; 7 ; 8 ; 10 ; n ; 2 ; / ; I3 ; I4 ; n ; n ; [end of the subclasses' identification] r ; a ; 3 ; y ; n ; s ; nl ; t ; I ; I ; [you can see on the screen that there are I objects with NL = 2; code NL with the threshold 2] n ; h ; 2 / ; y ; n ; s ; n ; n ; COEX ; n ; RAEX ; y ; [you

### III. Pattern recognition with the Cora algorithm

Use program COR , no initial silence file and data from RAEX. Create silence file KAEX with parameters from the following correct sequence of actions:

```
COR>
TSM>GO COR ;^KAEX ; c ; RAEX ; I0 ; n ; y [or I] ; 2,I,2,I ; n ; n ; y ;
y,y ; n,n ; y,n ; y ; n ; d [you can see on the screen the numbers of traits selected: PI = I and P2 = I, it is not so bad for such a small data set] ; [the screen shows: latices of traits, traits, 2-dimentional table of voting; take delta equal to I] I ; [classification for delta = I is flashed] n ; n ; [the voting is flashed] TSM>
```

### IV. Pattern recognition with the HAM algorithm

Use program HAM , no initial silence file and data from RAEX. Create the silence file HAEX. To check yourself follow the correct sequence of actions:

```
HAM>                               n;
TSM>GO HAM ;^HAEX ; c ; RAEX ; n ; n ;^ [the kernel and weights are flashed]
n ; / ; n ; n ; [the screen shows the voting (the Hamming's distances)]
TSM>
```

Punch LOG to check your directory.

Delete the files: OREX, COEX, RAEX, KAEX, HAEX.

YOU HAVE GONE THROUGH P.P. PROGRAMS WITH THIS EXAMPLE AND GOT ACQUAINTED WITH THEM, GO TO CALIFORNIA DATA [I].

Let us repeat the results from [I]. The data are already filed in COCLF.D, ORCLF.D, RACLF.D, KACLF.D .

V. Code parameters. Use COD. Do not change the answers in the silence files. Make sure you understand the meaning of each answer. To check yourself follow the correct sequence of actions :

```
COD>
TSM>GO COD ;^COCLF.D ; y ; / ; n [be careful not to punch Y; it will lead to new class identificatin for all objects] ; y ; n ; param ; [there is no such parameter in ORCLF.D; names of parameters are flashed] h0 ; h ;
200,I200/ [in brackets there are thresholds from [i]; for practice just repeat them] ; y ; n ; s ; e.t.c. (to flash the list of all parameters punch any unexisting one) ... rgen ; b ; t5,11/ ; ... ; n ; ^ ; n ; n ; n ;
n ; n ; y ; [the coding is finished] QTY>
```

### VI. Pattern recognition with the Cora-3 algorithm. Use COR.X.

COR>

```
TSM>GO COR ;^KACLF ; y ; n ; [data from RACLF.D are flashed, for practice just repeat the answers indicated in brackets] y ; 6,4,I2,2 ; n ; n ;
y ; y,y ; n,n ; y,n ; y ; [data from RACLF.D are flashed] n ; [runs the algorithm] [flashed are:
L = I9 NI =43 N2 = 4I N3 = I4 KI =6 KIT = 4 K2 = I2 K2T = 2
NPM =30 PI =I5 P2 = I3 IN =I ] d ; [latices of traits, traits, 2-dimentional table of voting, numbers of objects with voting greater than k (k = -5, -4, ..., 4, 5) are flashed] [punch data as in [I]: 2]
2 ; n ; n ; [the voting is flashed] TSM>
```

If you have time try to change the coding of the parameters and other answers. Use the HAM algorithm as well as the Cora-3.

29 NOV 85 11:23:2

TASK # 07000005

30

GOULD S.E.L. MPX-32 2.14 S.SYS9.S

```

1: EXERCISES FROM NUMBER 1
2: SELECT FROM CATALOG 1A, 1B, OM TO 1981 EVENTS 1 0 0
3: INPUT 1980YRZ1W, 0H, 0M TO 1981 1 0 0
4: COEF. MAGNITUDE - .00
5: PARITY MAX -1.00, MS- 1.00, .30, NL- 1.00, .00, NPM- 1.00, .00
6: WIND MAX MAGNITUDE -30, 9.00
7: DEATHN OF REC'D. CR: 00
8: FROM 112.00 TO 155.00
9: AND FROM 174.00 TO 200
10: AXIS PITCH METERS : *****
11: ***** HORIZONTAL AXES : *****
12: ***** LONGITUDE : *****
13: ***** INTERVAL 1.54,00, 1.55,00 : *****
14: ***** VERTICAL : *****
15: ***** INTERVAL -12.00,00, SHIFT -5.00
16: SEGMENT 1 -12.00,00 : *****
17: ***** COUNTOUT INFILE PRIDESILE Y DSKP
18: ***** NO VARIABLE LIST : *****
19: ***** COUNTOUT INFILE SILE142.DSKP
20: ***** NO VARIABLE LIST : *****
21: ***** COUNTOUT INFILE SILE133.DSKP
22: ***** NO VARIABLE LIST : *****
23: ***** COUNTOUT INFILE SILE132.DSKP
24: ***** NO VARIABLE LIST : *****
25: ***** COUNTOUT INFILE SILE131.DSKP
26: ***** NO VARIABLE LIST : *****
27: ***** COUNTOUT INFILE SILE130.DSKP
28: ***** NO VARIABLE LIST : *****
29: ***** COUNTOUT INFILE SILE129.DSKP
30: ***** NO VARIABLE LIST : *****
31: ***** COUNTOUT INFILE SILE128.DSKP
32: ***** NO VARIABLE LIST : *****
33: ***** COUNTOUT INFILE SILE127.DSKP
34: ***** NO VARIABLE LIST : *****
35: ***** COUNTOUT INFILE SILE126.DSKP
36: ***** NO VARIABLE LIST : *****
37: ***** COUNTOUT INFILE SILE125.DSKP
38: ***** NO VARIABLE LIST : *****
39: ***** COUNTOUT INFILE SILE124.DSKP
40: ***** NO VARIABLE LIST : *****
41: ***** COUNTOUT INFILE SILE123.DSKP
42: ***** NO VARIABLE LIST : *****
43: ***** COUNTOUT INFILE SILE122.DSKP
44: ***** NO VARIABLE LIST : *****
45: ***** COUNTOUT INFILE SILE121.DSKP
46: ***** NO VARIABLE LIST : *****
47: ***** COUNTOUT INFILE SILE120.DSKP
48: ***** NO VARIABLE LIST : *****
49: ***** COUNTOUT INFILE SILE119.DSKP
50: ***** NO VARIABLE LIST : *****
51: ***** COUNTOUT INFILE SILE118.DSKP
52: ***** NO VARIABLE LIST : *****
53: ***** COUNTOUT INFILE SILE117.DSKP
54: ***** NO VARIABLE LIST : *****
55: ***** COUNTOUT INFILE SILE116.DSKP
56: ***** NO VARIABLE LIST : *****
57: ***** COUNTOUT INFILE SILE115.DSKP
58: ***** NO VARIABLE LIST : *****
59: ***** COUNTOUT INFILE SILE114.DSKP
60: ***** NO VARIABLE LIST : *****
61: ***** COUNTOUT INFILE SILE113.DSKP
62: ***** NO VARIABLE LIST : *****
63: ***** COUNTOUT INFILE SILE112.DSKP
64: ***** NO VARIABLE LIST : *****
65: ***** COUNTOUT INFILE SILE111.DSKP
66: ***** NO VARIABLE LIST : *****
67: ***** COUNTOUT INFILE SILE110.DSKP
68: ***** NO VARIABLE LIST : *****
69: ***** COUNTOUT INFILE SILE109.DSKP
70: ***** NO VARIABLE LIST : *****
71: ***** COUNTOUT INFILE SILE108.DSKP
72: ***** NO VARIABLE LIST : *****
73: ***** COUNTOUT INFILE SILE107.DSKP
74: ***** NO VARIABLE LIST : *****
75: ***** COUNTOUT INFILE SILE106.DSKP
76: ***** NO VARIABLE LIST : *****
77: ***** COUNTOUT INFILE SILE105.DSKP
78: ***** NO VARIABLE LIST : *****
79: ***** COUNTOUT INFILE SILE104.DSKP
80: ***** NO VARIABLE LIST : *****
81: ***** COUNTOUT INFILE SILE103.DSKP
82: ***** NO VARIABLE LIST : *****
83: ***** COUNTOUT INFILE SILE102.DSKP
84: ***** NO VARIABLE LIST : *****
85: ***** COUNTOUT INFILE SILE101.DSKP
86: ***** NO VARIABLE LIST : *****
87: ***** COUNTOUT INFILE SILE100.DSKP
88: ***** NO VARIABLE LIST : *****
89: ***** COUNTOUT INFILE SILE99.DSKP
90: ***** NO VARIABLE LIST : *****
91: ***** COUNTOUT INFILE SILE98.DSKP
92: ***** NO VARIABLE LIST : *****
93: ***** COUNTOUT INFILE SILE97.DSKP
94: ***** NO VARIABLE LIST : *****
95: ***** COUNTOUT INFILE SILE96.DSKP
96: ***** NO VARIABLE LIST : *****
97: ***** COUNTOUT INFILE SILE95.DSKP
98: ***** NO VARIABLE LIST : *****
99: ***** COUNTOUT INFILE SILE94.DSKP
100: ***** NO VARIABLE LIST : *****
101: ***** COUNTOUT INFILE SILE93.DSKP
102: ***** NO VARIABLE LIST : *****
103: ***** COUNTOUT INFILE SILE92.DSKP
104: ***** NO VARIABLE LIST : *****
105: ***** COUNTOUT INFILE SILE91.DSKP
106: ***** NO VARIABLE LIST : *****
107: ***** COUNTOUT INFILE SILE90.DSKP
108: ***** NO VARIABLE LIST : *****
109: ***** COUNTOUT INFILE SILE89.DSKP
110: ***** NO VARIABLE LIST : *****
111: ***** COUNTOUT INFILE SILE88.DSKP
112: ***** NO VARIABLE LIST : *****
113: ***** COUNTOUT INFILE SILE87.DSKP
114: ***** NO VARIABLE LIST : *****
115: ***** COUNTOUT INFILE SILE86.DSKP
116: ***** NO VARIABLE LIST : *****
117: ***** COUNTOUT INFILE SILE85.DSKP
118: ***** NO VARIABLE LIST : *****
119: ***** COUNTOUT INFILE SILE84.DSKP
120: ***** NO VARIABLE LIST : *****
121: ***** COUNTOUT INFILE SILE83.DSKP
122: ***** NO VARIABLE LIST : *****
123: ***** COUNTOUT INFILE SILE82.DSKP
124: ***** NO VARIABLE LIST : *****
125: ***** COUNTOUT INFILE SILE81.DSKP
126: ***** NO VARIABLE LIST : *****
127: ***** COUNTOUT INFILE SILE80.DSKP
128: ***** NO VARIABLE LIST : *****
129: ***** COUNTOUT INFILE SILE79.DSKP
130: ***** NO VARIABLE LIST : *****
131: ***** COUNTOUT INFILE SILE78.DSKP
132: ***** NO VARIABLE LIST : *****
133: ***** COUNTOUT INFILE SILE77.DSKP
134: ***** NO VARIABLE LIST : *****
135: ***** COUNTOUT INFILE SILE76.DSKP
136: ***** NO VARIABLE LIST : *****
137: ***** COUNTOUT INFILE SILE75.DSKP
138: ***** NO VARIABLE LIST : *****
139: ***** COUNTOUT INFILE SILE74.DSKP
140: ***** NO VARIABLE LIST : *****
141: ***** COUNTOUT INFILE SILE73.DSKP
142: ***** NO VARIABLE LIST : *****
143: ***** COUNTOUT INFILE SILE72.DSKP
144: ***** NO VARIABLE LIST : *****
145: ***** COUNTOUT INFILE SILE71.DSKP
146: ***** NO VARIABLE LIST : *****
147: ***** COUNTOUT INFILE SILE70.DSKP
148: ***** NO VARIABLE LIST : *****
149: ***** COUNTOUT INFILE SILE69.DSKP
150: ***** NO VARIABLE LIST : *****
151: ***** COUNTOUT INFILE SILE68.DSKP
152: ***** NO VARIABLE LIST : *****
153: ***** COUNTOUT INFILE SILE67.DSKP
154: ***** NO VARIABLE LIST : *****

```

Table 1.

11:29:22 TASK # 070000005 GND S E-1 NAV-T2 2 14 S VSSC

Table 2.

```

29NOV33 12:09:37 TASK # J7000005 CO3 GOULD S.E.L. MPX-32 2.1A

1: EXERCISES FROM NUMBER OF CAPASID 1 82299 EVENTS 1 0
   INPUT CATALOGUE - 0M TO 1934 EVENTS 1 0
   INP1 MAGNETIC JUDGE - .00
   COEF FOR MAGN
   NS FOR MAGN
   PRIORITY MAX .00, MS- 1.00, *00,ML- 1.00, .00,MP- 1.00, .00
   MAXIMUM MAGNITUDE: 1.00, 9.00
   MINIMUM MAGNITUDE: -1.00, 0.00
   DEPTH IN KM: 0.00, 0.00
   4: PLATON OF BRET.(?) FROM -10.00 TO 10.00 *147.20
      AND FROM 10.00 TO 10.00 PRINT SUBCAT-N
      TYPE SUBCATIONS - PRINTS
      OUTPAUT2CATLOGS - SILENCE FILE-
      END OF SCAT 1936 EVENTS

```

To the exercise Ia.

Table 3

29NOV83 12:55:20 TASK # 070000005

62

G2010\_S1\_E1\_1

5  
e  
—  
Tc

Table 6. ( $\Sigma$  is omitted on the screen but kept on printout.)

