

PROBLEM SET #4:
DETERMINING FOCAL MECHANISM SOLUTIONS

DUE: 09/23/2003

- 1) You are given the nodal planes for earthquakes a through g below. For each event, the ray leaving the focus at an angle from horizontal $I = 45^\circ$ and an azimuth $D = 45^\circ$ is a dilatation. For each earthquake, plot on a lower hemisphere projection:
- a. The nodal planes
 - b. The slip vector(s) (S), the compression axis (P), and the tension axis (T)
 - c. The poles of the nodal planes
 - d. The quadrants of compression (shaded).

Finally, for each earthquake, describe the nature of the faulting (for example, right-lateral with a small component of thrust faulting toward the north).

Earthquake	Fault Plane		Auxiliary Plane	
	strike	dip	strike	dip
a	20°	30° SE	200°	60° NW
b	100°	80° SW	10°	90°
c	10°	90°	100°	80° SW
d	0°	20° W	180°	70° E
e	135°	50° NE	315°	40° SW
f	26°	70° SE	80°	32° NW
g	33°	70° SE	71°	25° NW

- 2) A magnitude 6.3 earthquake with a hypocentral depth of 300 km is located near the Kamchatka peninsula. As a seismologist, you have obtained seismograms from 28 global seismic stations and have determined the first motions listed in the following table. In the table, D is the azimuth from the epicenter to each seismographic station, I is the angle from the horizontal at which each ray left the hypocenter, ● indicates first motions that were compressions, ○ indicates those that were dilatations, and **X** indicates those that were nodal arrivals. Now you want to utilize these data to construct a focal mechanism solution.
- Plot the compressions, dilatations, and nodal arrivals using a stereonet. Make an estimate of the best-fitting nodal planes and the P and T axes. Remember that the 2 nodal planes must be orthogonal with respect to one another.
 - Determine the strike and dip of the nodal planes, along with an estimate of the uncertainty in each.
 - What additional information would you need to determine which nodal plane is the fault plane?

Pt. #	D	I	1 st motion
1	258°	18°	●
2	150°	63°	X
3	108°	28°	○
4	63°	74°	●
5	29°	61°	●
6	55°	23°	●
7	74°	22°	○
8	138°	23°	○
9	237°	46°	●
10	152°	27°	X
11	192°	10°	X
12	244°	30°	○
13	86°	10°	○
14	278°	38°	○
15	297°	29°	○
16	290°	19°	○
17	120°	7°	○
18	197°	64°	●
19	338°	38°	○
20	318°	61°	●
21	351°	55°	●
22	351°	30°	○
23	237°	73°	●
24	29°	47°	○
25	67°	26°	X
26	358°	42°	X
27	176°	24°	●
28	176°	20°	○

