PROBABILISTIC SEISMIC HAZARD ANALYSIS

Minimum Magnitude : m_0 = 5
Maximum Magnitude : m_u = 7.4
Frecuency-Magnitud Relationship : a = 2.55
b = 0.88

A. Divide the seismic source zone into a set of subsonic zone

Subzone	**1**	**2**	**3**	**Total**
Area (km^2)	2000	1500	2500	6000
R_i (km)	20	30	40	

B. Calculate the occurrence rate of earthquakes with magnitude larger than the minimum magnitude m0

ν (m>5) = N (m>5) = e^(2.55-.88*m_0) = 0.157

C. Probability Density Function

$f_M(m) = k * \beta * e^{(-\beta(m_{mid}-m_0))}$

$k = (1 - e^{(-\beta (m_u - m_0))})^{-1}$

m	5	5.4	5.4	5.8	5.8	6.2	6.2	6.6	6.6	7	7	7.4
m_{mid}	5.2		5.6		6		6.4		6.8		7.2	
$f(m_{mid})$	1.36165505		0.60543441		0.26919507		0.11969255		0.05321905		0.02366285	

D. Acceleration Attenuation Function

Ln (y) = 1.31 + 1.15 m - 0.83 ln R - 0.0028 R

R (km)	**m**					
	5.2	5.6	6	6.4	6.8	7.2
20	0.11530055	0.1826446	0.28932257	0.45830835	0.72599434	1.15002874
30	0.0800784	0.12685011	0.20093996	0.31830377	0.50421672	0.79871659
40	0.0613276	0.09714746	0.15388877	0.24377119	0.38615161	0.61169271

Now we compute the occurrence rate of specified acceleration values when earthquakes occur in each subzone:

Acceleration	5.2			5.6			6			6.4			6.8			7.2		
(g)	20	30	40	20	30	40	20	30	40	20	30	40	20	30	40	20	30	40
0.05	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.10	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
0.15	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
0.20	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1
0.25	0	0	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	1
0.30	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1
0.35	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1
0.40	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	1
0.45	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	1
0.50	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1
0.55	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1
0.60	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1
0.65	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0
0.70	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0
0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
0.80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

Now we can obtain the occurrence rate specified acceleration values when earthquakes occur in each subzone by summation the multiple of contribution of each magnitude range and its probability function $f(m_j)$

$$P_i\,(y>Y) = \Sigma\, P_j\,(y>Y) * f(m_j)$$

Then, we calculate the total occurrence rate specified acceleration values when earthquakes occur in this seismic zone as:

$$P\,(y>Y) = \upsilon\, /\, S\, \Sigma\, S_i\, P_j\,(y>Y)$$

And the probability of y>Y occurs at least one time in one year can be computed as:

$$P_{1yr} = (y>Y) = 1 - e\ \hat{}\ -P_j\,(y>Y)$$

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g	P_i (y>Y)			P (y>Y)	P_{1yr}
	20	30	40		
0.05	2.43285898	2.43285898	2.43285898	0.38253585	0.31787057
0.10	2.43285898	1.07120393	0.46576952	0.20013533	0.18138004
0.15	1.07120393	0.46576952	0.46576952	0.10496854	0.09964716
0.20	0.46576952	0.46576952	0.19657445	0.05559983	0.05408241
0.25	0.46576952	0.19657445	0.0768819	0.03717625	0.0364937
0.30	0.19657445	0.19657445	0.0768819	0.02306709	0.02280308
0.35	0.19657445	0.0768819	0.0768819	0.01836206	0.01819451
0.40	0.19657445	0.0768819	0.02366285	0.01487539	0.0147653
0.45	0.19657445	0.0768819	0.02366285	0.01487539	0.0147653
0.50	0.0768819	0.0768819	0.02366285	0.00860202	0.00856513
0.55	0.0768819	0.02366285	0.02366285	0.00651002	0.00648887
0.60	0.0768819	0.02366285	0.02366285	0.00651002	0.00648887
0.65	0.0768819	0.02366285	0	0.00495973	0.00494745
0.70	0.0768819	0.02366285	0	0.00495973	0.00494745
0.75	0.02366285	0.02366285	0	0.0021704	0.00216804
0.80	0.02366285	0	0	0.00124023	0.00123946