T4S.2: (a) 200000, 020000,. . . ,000002 (total 6),110000,101000,100100,. . . , 100001 (total 5), 011000,010100,. . . ,010001 (total 4), 001100,001010,001001 (total 3), 000110,000101 (total 2), 000011 (total 1) = 21

(b) $U_B = 6$: $11!/6!5! = 462$; $U_B = 9$: $14!/9!5! = 2002$

T4S.4: (a) Table:

U_A	U_B	Ω_A	Ω_B	Ω_{AB}
0	9	1	2002	2002
1	8	3	1287	3861
2	7	6	792	4752
3	6	10	462	4620
4	5	15	252	3780
5	4	21	126	2646
6	3	28	56	1568
7	2	36	21	756
8	1	45	6	270
9	0	55	1	55

(b) $U_A = 2$, $U_B = 7$; clearly neither $U_A = U_B$ nor $U_A/N_A = U_B/N_B$

T4S.7: (a) Table:

		at maximum probability		
N_A	N_B	$U_A : U_B$	U_A/N_A	U_B/N_B
50	50	100:100	2.00	2.00
40	60	80:120	2.00	2.00
30	70	60:140	2.00	2.00
20	80	39:161	1.95	2.01
10	90	19:181	1.90	2.01

$U_A/N_A \approx U_B/N_B$

(b) Table for $U = 200099$

		at maximum probability		
N_A	N_B	U_A/U_B	U_A/N_A	U_B/N_B
5000	5000	1.0000	2.000	2.000
4000	6000	0.6681	2.003	1.998
3000	7000	0.4306	2.007	1.997
2000	8000	0.2524	2.015	1.996
1000	9000	0.1136	2.040	1.996

T4R.1: (a) Let $q = U/\varepsilon$, then $n = q$

(b) We need to select the n atoms out of N that are in the excited state; there are $\binom{N}{n} = \frac{N!}{n! \cdot (N-n)!}$ ways of doing this.

(c) Table:

U_A	U_B	Ω_A	Ω_B	Ω_{AB}
0	8	1	125970	125970
1	7	20	77520	1550400
2	6	190	38760	7364400
3	5	1140	15504	17674560
4	4	4845	4845	23474025
5	3	15504	1140	17674560
6	2	38760	190	7364400
7	1	77520	20	1550400
8	0	125970	1	125970