

www.kotobarabia.com

نعيم صبرى

حافظ  
بتاع الروبايكييا  
رواية



www.kotobarabia.com





---

---

## طبقا لقوانين الملكية الفكرية

جميع حقوق النشر و التوزيع الالكتروني  
لهذا المصنف محفوظة لكتب عربية. يحظر  
نقل أو إعادة نسخ أو إعادة بيع أى جزء من  
هذا المصنف و بثه الكترونيا (عبر الانترنت أو  
للمكتبات الالكترونية أو الأقراص المدمجة أو أى  
وسيلة أخرى) دون الحصول على إذن كتابي من  
كتب عربية. حقوق الطبع الورقى محفوظة  
للمؤلف أو ناشره طبقا للتعاقدات السارية.

---

---

( )

...!

...!

...!

...!

...

...!

...

.

-

.

-

!

-

.

-

.

-

.

-

.

...

-

.

-

.

-

...

-

!

...!

-

.

...

-

.

-

!

-

	...	...		-
...	!	...	...	-
		!		-
				-
	.	...		-
				-
...		...		-
			...	-
		.		-
		.		-
	.	.	...	-
	;			-
	.	...		-
		...		-
		...		-
		...	...	-
				-
		.		-
	.	.	.	-

( )

. -

.

.

.

:

.

.

-

.

.

.

.

.

.

.

:

-

:

.



...

...

...

.

( )

.

.

.

.

...!

.

.

...! ...

.

:

.

...

-

.

.

.

-

.

...

-

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

...	...	...	-
	...	...	
	.	...	
...	...	...	-
.		...	-
...!		...	-
	.	...	-
	...		-
		...	
:	.		
	!	...	-
		...	-

		...	-
		...	-
		...	-
		:	-
	.	...	-
		.	-
	:		-
		...	-
	.		-
		:	-
		.	-
		:	-
	.		-
		:	-
	.	...	-
		.	-
	:	...	-
...	...		-
	...	...	-
		...	-

( )

!



.

.

.

:

-

:

.

...

-

.

.

.

:

( )

( )

:

-

...

.

:

...!

...!

-

...

...

.

.

:

...

...

-

...

...

...

...!

...!

...!

.

...

-

:

...! -

... .. -

... ..

...

...

. ...

...! -

...!

... .. -

... ..

... ..

... ..! -

...! -

... -

. ...

-

. ... -

	...	-
		!
...		-
	.	
	...	...
...		-
	...	
...		...
	...	!
	...	-
	.	
	...	
	:	.
	.	-
	.	
...	...	...
	:	
...		-



... .. -

...

...

...

.

.

...

...!

-

.

-

.

...!

-

.

-

.

.

.

1	...	-
2	...	-
3	...	-
4	...	-
5	...	-
6	...	-
7	...	-
8	...	-
9	...	-
10	...	-
11	...	-
12	...	-
13	...	-
14	...	-
15	...	-
16	...	-
17	...	-
18	...	-
19	...	-
20	...	-
21	...	-
22	...	-
23	...	-
24	...	-
25	...	-
26	...	-
27	...	-
28	...	-
29	...	-
30	...	-
31	...	-
32	...	-
33	...	-
34	...	-
35	...	-
36	...	-
37	...	-
38	...	-
39	...	-
40	...	-
41	...	-
42	...	-
43	...	-
44	...	-
45	...	-
46	...	-
47	...	-
48	...	-
49	...	-
50	...	-
51	...	-
52	...	-
53	...	-
54	...	-
55	...	-
56	...	-
57	...	-
58	...	-
59	...	-
60	...	-
61	...	-
62	...	-
63	...	-
64	...	-
65	...	-
66	...	-
67	...	-
68	...	-
69	...	-
70	...	-
71	...	-
72	...	-
73	...	-
74	...	-
75	...	-
76	...	-
77	...	-
78	...	-
79	...	-
80	...	-
81	...	-
82	...	-
83	...	-
84	...	-
85	...	-
86	...	-
87	...	-
88	...	-
89	...	-
90	...	-
91	...	-
92	...	-
93	...	-
94	...	-
95	...	-
96	...	-
97	...	-
98	...	-
99	...	-
100	...	-

-

-

.

-

-

...

...

...

...

-

-

.

-

-

.

.

...!

-

...

-

.

...

...!

...

...

...

...

...

...

...

-

.

.

.

-

.

-

.

...

.

.

...!

...!

-

...

-

...

...

...

...

...

...

...

...

.

.

...

...

...

-

.

...

...

-

...

-

( )

.

.

( )

.

.

.

.

.

.

.

.

.

.

.

.

...

...

...

...

.

.

.

...!

...

.

.

.

.

.

...

...!

:

.

...!

.

...

...!

.

.

...

...

.

.

.

...

...!

...

...

...

.

.

.

...

.

-

-

-

.

-

-

...

4.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.	71.	72.	73.	74.	75.	76.	77.	78.	79.	80.	81.	82.	83.	84.	85.	86.	87.	88.	89.	90.	91.	92.	93.	94.	95.	96.	97.	98.	99.	100.	101.	102.	103.	104.	105.	106.	107.	108.	109.	110.	111.	112.	113.	114.	115.	116.	117.	118.	119.	120.	121.	122.	123.	124.	125.	126.	127.	128.	129.	130.	131.	132.	133.	134.	135.	136.	137.	138.	139.	140.	141.	142.	143.	144.	145.	146.	147.	148.	149.	150.	151.	152.	153.	154.	155.	156.	157.	158.	159.	160.	161.	162.	163.	164.	165.	166.	167.	168.	169.	170.	171.	172.	173.	174.	175.	176.	177.	178.	179.	180.	181.	182.	183.	184.	185.	186.	187.	188.	189.	190.	191.	192.	193.	194.	195.	196.	197.	198.	199.	200.
----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

1.1	1	-
1.2	1	-
1.3	1	-
1.4	1	-
1.5	1	-
1.6	1	-
1.7	1	-
1.8	1	-
1.9	1	-
1.10	1	-
1.11	1	-
1.12	1	-
1.13	1	-
1.14	1	-
1.15	1	-
1.16	1	-
1.17	1	-
1.18	1	-
1.19	1	-
1.20	1	-
1.21	1	-
1.22	1	-
1.23	1	-
1.24	1	-
1.25	1	-
1.26	1	-
1.27	1	-
1.28	1	-
1.29	1	-
1.30	1	-
1.31	1	-
1.32	1	-
1.33	1	-
1.34	1	-
1.35	1	-
1.36	1	-
1.37	1	-
1.38	1	-
1.39	1	-
1.40	1	-
1.41	1	-
1.42	1	-
1.43	1	-
1.44	1	-
1.45	1	-
1.46	1	-
1.47	1	-
1.48	1	-
1.49	1	-
1.50	1	-
1.51	1	-
1.52	1	-
1.53	1	-
1.54	1	-
1.55	1	-
1.56	1	-
1.57	1	-
1.58	1	-
1.59	1	-
1.60	1	-
1.61	1	-
1.62	1	-
1.63	1	-
1.64	1	-
1.65	1	-
1.66	1	-
1.67	1	-
1.68	1	-
1.69	1	-
1.70	1	-
1.71	1	-
1.72	1	-
1.73	1	-
1.74	1	-
1.75	1	-
1.76	1	-
1.77	1	-
1.78	1	-
1.79	1	-
1.80	1	-
1.81	1	-
1.82	1	-
1.83	1	-
1.84	1	-
1.85	1	-
1.86	1	-
1.87	1	-
1.88	1	-
1.89	1	-
1.90	1	-
1.91	1	-
1.92	1	-
1.93	1	-
1.94	1	-
1.95	1	-
1.96	1	-
1.97	1	-
1.98	1	-
1.99	1	-
2.00	1	-

( )

.

.

.

.

.

.

.

.

:

-

-

.

:

-

:

...!

-

:

-

.

:

.

:

.

:

...

...

...!

:

.

...

:

.

:

.

...

:

.

:

...

...!

:

.

-

-

-

-

-

-

-

-

-

-





( )

..!

..

...!

...

...!

...!

...

...

...

...

( )

:

...      ...!      ...!      -

:

...

:

..

!

...

:

...

.

.

.

.

:

.

.

.

.

...!

...!

...

...

.

...

:

.

.

...

-

.

-

.

( )

:

.

-

.

.

.

:

.

-

( )

... ..

...!

( )

:

-

.

.

.

.

.

:

.

...

-

:

...			-
	...	...	-
		...	-
		...!	-
		.	-
.			-
:	.		-
		...	-
.		...	-
			-
		.	-
		:	-
		...	-
		.	-
		.	-
:		.	-
		...	-
		.	-



-

...

...

-

...

...

-

...

...

( )

.

-

-

-

...!

...

-

... "The first thing I did was to get a job. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

... "I was a clerk in a bank. I was a clerk in a bank."

:

-

:

-

...

...

...

...

( )

:

-

.

...

:

...!

-

:

!

...

-

·  
:

·

·

·

·

( )

... ..

-

· ... ..

... ..

·

:

.

-

.

...

.

.

.

...

...!

...!

...

...

...

.

.

:

...

-

:

14

... ..

:

...!

. ... ...

.

.

... ..

...!

...!

.

.

.

.

.

.

...!

...

( )

.

...

...

...

.

.

....

.

.

:

...!

...

-

:

...

...

-

.

:

....

-

...

...

...

.

.

.

.



( )



. -  
 . -  
 .... -  
 . -  
 . -  
 .... -  
 ....! -  
 -  
 .... -  
 ....! -  
 . -  
 . -  
 : -  
 . -  
 . -  
 . -  
 . -  
 . -  
 .... -  
 : -  
 . -  
 . -

. ... -

:

... -

.

.

.

...!

...

.

.

.

( )

:

...! -

...



...

...

...

( )

... ..

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...

( )

( )

...

( )

( )

:

-

:

-

...

.

.

( )

:

.



\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*

\*

\*

||

||

\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*

\*\*\*

\*\*\*

\*\*\*

\*\*\*

\*

\*\*\*

\*

\*

\*\*\*

\*

2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. ...
10. ...
11. ...
12. ...
13. ...
14. ...
15. ...
16. ...
17. ...
18. ...
19. ...
20. ...
21. ...
22. ...
23. ...
24. ...
25. ...
26. ...
27. ...
28. ...
29. ...
30. ...
31. ...
32. ...
33. ...
34. ...
35. ...
36. ...
37. ...
38. ...
39. ...
40. ...
41. ...
42. ...
43. ...
44. ...
45. ...
46. ...
47. ...
48. ...
49. ...
50. ...
51. ...
52. ...
53. ...
54. ...
55. ...
56. ...
57. ...
58. ...
59. ...
60. ...
61. ...
62. ...
63. ...
64. ...
65. ...
66. ...
67. ...
68. ...
69. ...
70. ...
71. ...
72. ...
73. ...
74. ...
75. ...
76. ...
77. ...
78. ...
79. ...
80. ...
81. ...
82. ...
83. ...
84. ...
85. ...
86. ...
87. ...
88. ...
89. ...
90. ...
91. ...
92. ...
93. ...
94. ...
95. ...
96. ...
97. ...
98. ...
99. ...
100. ...

:

... .. -

... .. -

... .. -

... .. -

( )

.

.

.

.

.

...

...

...

...

...

...!

...

...

...

...

...!

...!

...! ...! ...

:

. ... -

... ...

... ...

... ... ...

...

... ...! ...!

... ...! ...! ... ...

... ... ...

... ... ...

... ... ...

... ...

.

( )

.

:

.

	...	-
	:	.
...	...!	-
	...	...!
...	...	...
	...	...!
	:	.
...	...!	...
	...	-
.	...	-
	...	...
	...!	...
	!	...
	.	-
	.	-
	:	-
	.	-
		-

...

...

...

-

...

...

...

...

( )

14.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k} = \ln 2$  (Theorem 7.20.1)
15.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6}$  (Theorem 7.20.1)
16.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^3} = \frac{\zeta(3)}{1}$  (Theorem 7.20.1)
17.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^4} = \frac{\zeta(4)}{1}$  (Theorem 7.20.1)
18.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^5} = \frac{\zeta(5)}{1}$  (Theorem 7.20.1)
19.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^6} = \frac{\zeta(6)}{1}$  (Theorem 7.20.1)
20.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^7} = \frac{\zeta(7)}{1}$  (Theorem 7.20.1)
21.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^8} = \frac{\zeta(8)}{1}$  (Theorem 7.20.1)
22.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^9} = \frac{\zeta(9)}{1}$  (Theorem 7.20.1)
23.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{10}} = \frac{\zeta(10)}{1}$  (Theorem 7.20.1)
24.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{11}} = \frac{\zeta(11)}{1}$  (Theorem 7.20.1)
25.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{12}} = \frac{\zeta(12)}{1}$  (Theorem 7.20.1)
26.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{13}} = \frac{\zeta(13)}{1}$  (Theorem 7.20.1)
27.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{14}} = \frac{\zeta(14)}{1}$  (Theorem 7.20.1)
28.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{15}} = \frac{\zeta(15)}{1}$  (Theorem 7.20.1)
29.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{16}} = \frac{\zeta(16)}{1}$  (Theorem 7.20.1)
30.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{17}} = \frac{\zeta(17)}{1}$  (Theorem 7.20.1)
31.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{18}} = \frac{\zeta(18)}{1}$  (Theorem 7.20.1)
32.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{19}} = \frac{\zeta(19)}{1}$  (Theorem 7.20.1)
33.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{20}} = \frac{\zeta(20)}{1}$  (Theorem 7.20.1)
34.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{21}} = \frac{\zeta(21)}{1}$  (Theorem 7.20.1)
35.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{22}} = \frac{\zeta(22)}{1}$  (Theorem 7.20.1)
36.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{23}} = \frac{\zeta(23)}{1}$  (Theorem 7.20.1)
37.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{24}} = \frac{\zeta(24)}{1}$  (Theorem 7.20.1)
38.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{25}} = \frac{\zeta(25)}{1}$  (Theorem 7.20.1)
39.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{26}} = \frac{\zeta(26)}{1}$  (Theorem 7.20.1)
40.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{27}} = \frac{\zeta(27)}{1}$  (Theorem 7.20.1)
41.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{28}} = \frac{\zeta(28)}{1}$  (Theorem 7.20.1)
42.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{29}} = \frac{\zeta(29)}{1}$  (Theorem 7.20.1)
43.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{30}} = \frac{\zeta(30)}{1}$  (Theorem 7.20.1)
44.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{31}} = \frac{\zeta(31)}{1}$  (Theorem 7.20.1)
45.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{32}} = \frac{\zeta(32)}{1}$  (Theorem 7.20.1)
46.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{33}} = \frac{\zeta(33)}{1}$  (Theorem 7.20.1)
47.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{34}} = \frac{\zeta(34)}{1}$  (Theorem 7.20.1)
48.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{35}} = \frac{\zeta(35)}{1}$  (Theorem 7.20.1)
49.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{36}} = \frac{\zeta(36)}{1}$  (Theorem 7.20.1)
50.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{37}} = \frac{\zeta(37)}{1}$  (Theorem 7.20.1)
51.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{38}} = \frac{\zeta(38)}{1}$  (Theorem 7.20.1)
52.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{39}} = \frac{\zeta(39)}{1}$  (Theorem 7.20.1)
53.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{40}} = \frac{\zeta(40)}{1}$  (Theorem 7.20.1)
54.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{41}} = \frac{\zeta(41)}{1}$  (Theorem 7.20.1)
55.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{42}} = \frac{\zeta(42)}{1}$  (Theorem 7.20.1)
56.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{43}} = \frac{\zeta(43)}{1}$  (Theorem 7.20.1)
57.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{44}} = \frac{\zeta(44)}{1}$  (Theorem 7.20.1)
58.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{45}} = \frac{\zeta(45)}{1}$  (Theorem 7.20.1)
59.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{46}} = \frac{\zeta(46)}{1}$  (Theorem 7.20.1)
60.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{47}} = \frac{\zeta(47)}{1}$  (Theorem 7.20.1)
61.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{48}} = \frac{\zeta(48)}{1}$  (Theorem 7.20.1)
62.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{49}} = \frac{\zeta(49)}{1}$  (Theorem 7.20.1)
63.  $\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \frac{1}{k^{50}} = \frac{\zeta(50)}{1}$  (Theorem 7.20.1)

© 2003 Jones & Bartlett Publishers, Inc.

All rights reserved. No part of this book may be reproduced, stored, transmitted, or disseminated in any form or by any means without the prior written permission of Jones & Bartlett Publishers, Inc.

( )

...

...

...

...

...

...

...

...

...

...

...!

...

...!

...

( )

:

-

.

...

...

-

...

.

.

.

.

:

...

...

-

...

...

...

...!

.

.

...  
...! ...  
...  
...  
...!  
...!  
...  
...  
...

... ! ...

( )

...  
...  
...!  
...

the fact that the  $\mathbb{Z}_2$ -action is not free, the quotient is not a manifold. However, the quotient is a stratified space, and the quotient map is a stratified map.

Let  $X$  be a stratified space, and let  $Y$  be a topological space. A stratified map  $f: X \rightarrow Y$  is a continuous map that maps strata to strata. More precisely, if  $S_i$  is a stratum of  $X$ , then  $f(S_i)$  is a stratum of  $Y$ .

Let  $X$  be a stratified space, and let  $Y$  be a topological space. A stratified map  $f: X \rightarrow Y$  is a continuous map that maps strata to strata. More precisely, if  $S_i$  is a stratum of  $X$ , then  $f(S_i)$  is a stratum of  $Y$ .

Let  $X$  be a stratified space, and let  $Y$  be a topological space. A stratified map  $f: X \rightarrow Y$  is a continuous map that maps strata to strata. More precisely, if  $S_i$  is a stratum of  $X$ , then  $f(S_i)$  is a stratum of  $Y$ .

Let  $X$  be a stratified space, and let  $Y$  be a topological space. A stratified map  $f: X \rightarrow Y$  is a continuous map that maps strata to strata. More precisely, if  $S_i$  is a stratum of  $X$ , then  $f(S_i)$  is a stratum of  $Y$ .

Let  $X$  be a stratified space, and let  $Y$  be a topological space. A stratified map  $f: X \rightarrow Y$  is a continuous map that maps strata to strata. More precisely, if  $S_i$  is a stratum of  $X$ , then  $f(S_i)$  is a stratum of  $Y$ .

Let  $X$  be a stratified space, and let  $Y$  be a topological space. A stratified map  $f: X \rightarrow Y$  is a continuous map that maps strata to strata. More precisely, if  $S_i$  is a stratum of  $X$ , then  $f(S_i)$  is a stratum of  $Y$ .

Let  $X$  be a stratified space, and let  $Y$  be a topological space. A stratified map  $f: X \rightarrow Y$  is a continuous map that maps strata to strata. More precisely, if  $S_i$  is a stratum of  $X$ , then  $f(S_i)$  is a stratum of  $Y$ .

Let  $X$  be a stratified space, and let  $Y$  be a topological space. A stratified map  $f: X \rightarrow Y$  is a continuous map that maps strata to strata. More precisely, if  $S_i$  is a stratum of  $X$ , then  $f(S_i)$  is a stratum of  $Y$ .

...

...

...

( )

:

-



	...			
:		...		
		...		-
.	...	...		
	...	...		
.		...		
:			...	
		...		-
	...	...		
.		...		
		...		
:			...	
		...		-
		...		
.	...	...		
		...		
.		...		
:			...	
		...		-
	...	...		
.		...		
		...		

...

:

...!

( )

:

...

...

...

:

...

... ..

... ..

... ..

... ..

... ..

... ..

... ..

... ..

...

...

...

...

...

...

... ..

...

...

...

... ..

...

...

...

...

...

...!

...

...!

...

...!

...

...

...

...

...

...

...!

...!

...!

...!

.

( )

...

...

.

.

Country	Year	Value	Unit
Algeria	1980	10.0	1000000000
	1981	10.0	1000000000
Angola	1980	10.0	1000000000
	1981	10.0	1000000000
Cuba	1980	10.0	1000000000
	1981	10.0	1000000000
Czechoslovakia	1980	10.0	1000000000
	1981	10.0	1000000000
Ecuador	1980	10.0	1000000000
	1981	10.0	1000000000
Ghana	1980	10.0	1000000000
	1981	10.0	1000000000
Greece	1980	10.0	1000000000
	1981	10.0	1000000000
Guatemala	1980	10.0	1000000000
	1981	10.0	1000000000
Honduras	1980	10.0	1000000000
	1981	10.0	1000000000
Indonesia	1980	10.0	1000000000
	1981	10.0	1000000000
Iran	1980	10.0	1000000000
	1981	10.0	1000000000
Iraq	1980	10.0	1000000000
	1981	10.0	1000000000
Italy	1980	10.0	1000000000
	1981	10.0	1000000000
Japan	1980	10.0	1000000000
	1981	10.0	1000000000
Korea	1980	10.0	1000000000
	1981	10.0	1000000000
Mexico	1980	10.0	1000000000
	1981	10.0	1000000000
Morocco	1980	10.0	1000000000
	1981	10.0	1000000000
Pakistan	1980	10.0	1000000000
	1981	10.0	1000000000
Peru	1980	10.0	1000000000
	1981	10.0	1000000000
Rwanda	1980	10.0	1000000000
	1981	10.0	1000000000
Senegal	1980	10.0	1000000000
	1981	10.0	1000000000
Tanzania	1980	10.0	1000000000
	1981	10.0	1000000000
Thailand	1980	10.0	1000000000
	1981	10.0	1000000000
Tunisia	1980	10.0	1000000000
	1981	10.0	1000000000
Yugoslavia	1980	10.0	1000000000
	1981	10.0	1000000000

...!	...	-
	... ..	-
.		
	...!	-
	...	-
...!		...
.		
	:	
.	...	-
...	...	-
:		
	.	-
	:	
	... ..	-
	:	
	!	-
	:	
	...	-
	:	

... . . . . .

... . . . . .

... . . . . . !

... . . . . .

... . . . . . !

... . . . . .

... . . . . .

... . . . . .

... . . . . .

... . . . . .

... . . . . .

.....

( )

:

.

-

:

-

.

:

-

.

:

-

:

-

...!

...!

:

				!	-
					-
				.	-
				...	-
			...	!	-
	...		...	!	-
.			...	!	-
		...		!	-
		...			-
	...	...		...	-
			...		-
			.		-
					-
...			...		-
	...			...	-
			...	...	-
				...	-
			...	!	-
				.	-
				:	-

	...	...	-
.		...	-
	:		-
	...		-
	...	...	
		...	
...		...	
	:	...	
	...!		-
	:		-
		...	-
		...	
.	...	...	
		:	
		...!	-
	:		-
...		...	-
	...	... ..	
.			



1  
1  
1  
1  
1  
1

.

...

:

...

...

.

...

-

...

:

.

-

:

...

...

-

.

:

.

...!

-

...

...

-

...!

( )

...

...!

...

...

...

...

	...	...
	...	...!
	...	...
... ..	...	...!
		...
...!	...	...!
...!		...
	...!	...!
...	...	...!
		.....!
	...	
	...	
	...	...

.

.

.

.

:

...

-

.

.

.

.

.

.

:

.

.

-

:

.

...

-

:

...

... -

...!

( )

( )

:  
 .  
 ...  
 .  
 :  
 .  
 ...  
 ..  
 :  
 :

( )

	.		
	.		.
	.		.
	:		
	!		-
:			
	.		-
:			
!	...		-
	:		
	.		-
:			
...	...		-
:			
.	...		-

.....

.....

· -  
:  
· · -  
:  
· · -  
:  
· · -  
:  
· · · · -  
:  
· · · · · -  
· · · · · -  
· · · · · -  
:  
· · · · · -

( )

...

...

...!

...

:

.

-

:

...

...

-

...

...

.

:

-

...

...!

( )

...

...

...

...

-

.

.

.

.

.

.

.

.

.

.

...

...

.

...

...

...

.

.

.

.

.

.

is  $\frac{1}{2}$  of the total, the number of boys is  $\frac{1}{2} \times 120 = 60$ .

It is important to stress that the number of girls is not  $\frac{1}{2}$  of the number of boys, but  $\frac{1}{2}$  of the total number of children.

When the problem is presented in the form of a word problem, it is important to underline the given information and the question.

**Example 2:** In a school, there are 120 children. There are 60 boys. How many girls are there?

**Solution:** Given: Total number of children = 120  
Number of boys = 60

To find: Number of girls

**Solution:** Let the number of girls be  $x$ .

Total number of children = Number of boys + Number of girls

$120 = 60 + x$

$120 - 60 = 60 + x - 60$

$60 = x$

$x = 60$

$\therefore$  Number of girls = 60

**Example 3:** In a school, there are 120 children. There are 60 boys. How many girls are there?

**Solution:** Let the number of girls be  $x$ .

Total number of children = Number of boys + Number of girls

$120 = 60 + x$

$120 - 60 = 60 + x - 60$

$60 = x$

$x = 60$

$\therefore$  Number of girls = 60

:

...

...

-

( )

...

...!

...

...!

:



:

...!

...

-

.

:

...!

-

( )

.

...

.

.

.

.

.

...

...

...

...

:

.

...



1.	.....	-
2.	.....	-
3.	.....	-
4.	.....	-
5.	.....	-
6.	.....	-
7.	.....	-
8.	.....	-
9.	.....	-
10.	.....	-
11.	.....	-
12.	.....	-
13.	.....	-
14.	.....	-
15.	.....	-
16.	.....	-
17.	.....	-
18.	.....	-
19.	.....	-
20.	.....	-
21.	.....	-
22.	.....	-
23.	.....	-
24.	.....	-
25.	.....	-
26.	.....	-
27.	.....	-
28.	.....	-
29.	.....	-
30.	.....	-
31.	.....	-
32.	.....	-
33.	.....	-
34.	.....	-
35.	.....	-
36.	.....	-
37.	.....	-
38.	.....	-
39.	.....	-
40.	.....	-
41.	.....	-
42.	.....	-
43.	.....	-
44.	.....	-
45.	.....	-
46.	.....	-
47.	.....	-
48.	.....	-
49.	.....	-
50.	.....	-
51.	.....	-
52.	.....	-
53.	.....	-
54.	.....	-
55.	.....	-
56.	.....	-
57.	.....	-
58.	.....	-
59.	.....	-
60.	.....	-
61.	.....	-
62.	.....	-
63.	.....	-
64.	.....	-
65.	.....	-
66.	.....	-
67.	.....	-
68.	.....	-
69.	.....	-
70.	.....	-
71.	.....	-
72.	.....	-
73.	.....	-
74.	.....	-
75.	.....	-
76.	.....	-
77.	.....	-
78.	.....	-
79.	.....	-
80.	.....	-
81.	.....	-
82.	.....	-
83.	.....	-
84.	.....	-
85.	.....	-
86.	.....	-
87.	.....	-
88.	.....	-
89.	.....	-
90.	.....	-
91.	.....	-
92.	.....	-
93.	.....	-
94.	.....	-
95.	.....	-
96.	.....	-
97.	.....	-
98.	.....	-
99.	.....	-
100.	.....	-

... ..

-

:

-

:

-

...!

...!

...!

( )

...

...

...

...

...!

.

...

...

...

.

...

...

.

.

.

.

.

( )

!.

...

-

...

-

.

...!

...!

-

-

.

.

-

-

.

-

-

...

.

.

-

.

-

:

-

-

...

...

...

.

...

( )

...!

...

:

...

-

...!

...

:

.

.

-

.

:

...

-

.

.

:

...

-

.

.

.

:

...!

...

...

-

:

.

...!

-

:



... ..  
 ...! ...  
 ...!  
 ... ..  
 ... ..  
 ...!  
 ... ..

( )

... ..  
 :  
 . -  
 : ... -  
 : -  
 : -  
 : -  
 : ...! ... -  
 .  
 :  
 . ... -



. ... -

.

( )

:

... -

...

...!

...!

...!

.

... -

... -

... -

... -

... -

...

.

...!

...!

...

...!

...

...

...

.

...

...

...

...

.

.

.

.

.

.

.

...

...

.

.

...!

...

Item	Value	Value	Value	Value
1	100	100	100	100
2	100	100	100	100
3	100	100	100	100
4	100	100	100	100
5	100	100	100	100
6	100	100	100	100
7	100	100	100	100
8	100	100	100	100
9	100	100	100	100
10	100	100	100	100
11	100	100	100	100
12	100	100	100	100
13	100	100	100	100
14	100	100	100	100
15	100	100	100	100
16	100	100	100	100
17	100	100	100	100
18	100	100	100	100
19	100	100	100	100
20	100	100	100	100
21	100	100	100	100
22	100	100	100	100
23	100	100	100	100
24	100	100	100	100
25	100	100	100	100
26	100	100	100	100
27	100	100	100	100
28	100	100	100	100
29	100	100	100	100
30	100	100	100	100
31	100	100	100	100
32	100	100	100	100
33	100	100	100	100
34	100	100	100	100
35	100	100	100	100
36	100	100	100	100
37	100	100	100	100
38	100	100	100	100
39	100	100	100	100
40	100	100	100	100
41	100	100	100	100
42	100	100	100	100
43	100	100	100	100
44	100	100	100	100
45	100	100	100	100
46	100	100	100	100
47	100	100	100	100
48	100	100	100	100
49	100	100	100	100
50	100	100	100	100
51	100	100	100	100
52	100	100	100	100
53	100	100	100	100
54	100	100	100	100
55	100	100	100	100
56	100	100	100	100
57	100	100	100	100
58	100	100	100	100
59	100	100	100	100
60	100	100	100	100
61	100	100	100	100
62	100	100	100	100
63	100	100	100	100
64	100	100	100	100
65	100	100	100	100
66	100	100	100	100
67	100	100	100	100
68	100	100	100	100
69	100	100	100	100
70	100	100	100	100
71	100	100	100	100
72	100	100	100	100
73	100	100	100	100
74	100	100	100	100
75	100	100	100	100
76	100	100	100	100
77	100	100	100	100
78	100	100	100	100
79	100	100	100	100
80	100	100	100	100
81	100	100	100	100
82	100	100	100	100
83	100	100	100	100
84	100	100	100	100
85	100	100	100	100
86	100	100	100	100
87	100	100	100	100
88	100	100	100	100
89	100	100	100	100
90	100	100	100	100
91	100	100	100	100
92	100	100	100	100
93	100	100	100	100
94	100	100	100	100
95	100	100	100	100
96	100	100	100	100
97	100	100	100	100
98	100	100	100	100
99	100	100	100	100
100	100	100	100	100





...!

...

...

...

...

...

.

.

...

...

.

.

.

...!

-

:

.

.

...

...

-

!.

-

...

...

...!

.

...

-

-

-

.

( )

:

1	...	...	...	...	-
2	.				
3	...				
4		...	...		
5				:	
6					-
7				:	
8					-
9					...
10			:		
11					-
12	.				
13				:	
14					-
15	...				
16	...	...	...	...	...
17	...				
18				:	
19					-
20				:	



( )

.

...

...

.

.

( )

.

:

.

.

-

:

.

...

.

...

-

.

...

-

.

.

.

.





( )

...

...

..

...

...

...

...

...

...

...

...

...

. ...!

...

... ..

...

.

.

:

-

:

. ... .. -

:

-

:

. ... -

!

-

:

! -

.

;

-

-

! ...

!

-

-

-

... ..

... ..

... ..

( )

...

...

...

...

...

...!

...

...

... ..!

... ..

... ..

... ..!

.

... ..

... ..

... ..

... ..

... ..! ..

. .

. .

( )

: .

... .. -

. ...! ..!

...

!

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...!

:

.

...

-

...!

...

-

.

.

.

.

... ..

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....







...

-

...!

( )

.

.

.

.

.

.

:

-

-

:

-

!

:



( )

:

... -

: ... -

...!

... -

... ...!

.

:

...!

:

... -

...!

... ...!

...!

...!

... -

...!



...

...

...

...!

...

...

...

...

...

...

...

...

...

...

...

...!

( )

.

.

...

...

...

...

...

...

...

...!

...

...

...

...

...

...

...!

...

...!

...

...

...!

...!

( )





...

...

...

...!

...

...

...

...

...

...

...

...

...

...

...

...!

...

...

...

...

...

...

...

...

...

...!

...

...

...

...

...

...

...

...

...

...

...

...

...

...

...

... ..  
... ..  
... ..

... ..

( )

.

:

...

-

:

!

-

:

...

...

...

-

...!

...

-

...

-

...

...

...

...!

...

-

:

...

...

-

...

...

...

...

:

...!

...!

-

:

...

...

-

:

...!

-

...

...

...

...

...

:

...

-

...

...

...





...

( )

... .

...!

...!

...

...!

...

...

...

...!

...!

...!

...



( )

	:		-
	...		-
...	...!	...	-
	...		-
	...		-
	...		-
...	...	...	-
:			-
...	...	...	-
	:		-
	...!		-
...	...	...	-
	:		-
	!		-
	:		-
	...	...	-
	...		-
...	...		-
...			-
:			-

	...	-
	...	...
	...	...
...	...	...
	...	...
	:	-
	.	-
	:	-
...	...	-
	.	-
:		-
	...	-
.	...	-
.	...	-
.	...	-

( )



... ..  
... ..  
... ..  
...! ...!  
...!

( )

:

! -  
:

! -  
-

:

! -  
... -

... ..  
... ..

... -  
-

! -  
...

...!  
...



...!

-

...!

-

...

-

...

-

...

-

( )

...

...

...

...

...

...

...

...

...

...

...

...

...

.

( )

. . . . .	10
. . . . .	11
. . . . .	12
. . . . .	13
. . . . .	14
. . . . .	15
. . . . .	16
. . . . .	17
. . . . .	18
. . . . .	19
. . . . .	20
. . . . .	21
. . . . .	22
. . . . .	23
. . . . .	24
. . . . .	25
. . . . .	26
. . . . .	27
. . . . .	28
. . . . .	29
. . . . .	30
. . . . .	31
. . . . .	32
. . . . .	33
. . . . .	34
. . . . .	35
. . . . .	36
. . . . .	37
. . . . .	38
. . . . .	39
. . . . .	40
. . . . .	41
. . . . .	42
. . . . .	43
. . . . .	44
. . . . .	45
. . . . .	46
. . . . .	47
. . . . .	48
. . . . .	49
. . . . .	50
. . . . .	51
. . . . .	52
. . . . .	53
. . . . .	54
. . . . .	55
. . . . .	56
. . . . .	57
. . . . .	58
. . . . .	59
. . . . .	60
. . . . .	61
. . . . .	62
. . . . .	63
. . . . .	64
. . . . .	65
. . . . .	66
. . . . .	67
. . . . .	68
. . . . .	69
. . . . .	70
. . . . .	71
. . . . .	72
. . . . .	73
. . . . .	74
. . . . .	75
. . . . .	76
. . . . .	77
. . . . .	78
. . . . .	79
. . . . .	80
. . . . .	81
. . . . .	82
. . . . .	83
. . . . .	84
. . . . .	85
. . . . .	86
. . . . .	87
. . . . .	88
. . . . .	89
. . . . .	90
. . . . .	91
. . . . .	92
. . . . .	93
. . . . .	94
. . . . .	95
. . . . .	96
. . . . .	97
. . . . .	98
. . . . .	99
. . . . .	100

...

.

.

:

.

-

...

...

...

...!

...

...

...!

...

...

...

...

...

...

( )

.

...

...

...

...

...

...!

...

...

...

.

...

( )

...!

...!

...!

...

...

...!

...

... ..

...!

...

... ..

... ..

...!

...!

( )

.

.

.

:

!

-

...

-

:

.  
:

...!

...!

...

...

...

...

...

( )

.  
:



	!	-
	:	-
...	...	-
	...	-
...	...	-
	...	-
	:	-
...	...	-
	:	-
...	...	-
	:	-
!	!	-
	:	-
...	...	-
	...	-







...

...

...

.

...

...

...

.

...

...

...

...!

...!

...

...

...

...

...

:

...

!

-

:

:

-

.

...

-

...

.

:

.

-

-

...

...

...

...

...

.

:

.

...

-

.

...

...

.

...

...

.

( )

.

.

.

...

:

.

...

-

:

-

:

-

-

:

-

...

-

...!

-

...

-

( )

...

.

.

...

...

.

.

.

.

... ..

...

... ..

.

( )

...

...

... ..

.

.

.

... ..

.

...

...!

...!

...

.

...

...

...

.

...

...

...

...

.

...

...

.

.

...

...!

( )

.

.

.

.

.

.

.











...

...

...

"...!"

.

"..."

...

...

.

...

...

.

...

-

-

.

( )

.

.

...

...

...

...! ...  
 ... ..  
 ... ..! ... ..  
 ...!  
 ...! ...! ...!  
 ...  
 ... ..!  
 ...! ... ..  
 ! ...  
 ...!  
 ...! ...!  
 .  
 ... .  
 . ...  
 ...  
 ...  
 ...!  
 :  
 -





...

.

...

...

.

( )

.

.

...

.

...

.

...

...!

...

...!

...

...!

...

...

...

.

...

...

...

...

...

...



： 。

。 -

：

...! -

( )

：

。 -

：

。 -

... ...! -

! -

：

。 -

：

：

...! ... ... -



( )

...

...

...

.

...

...

...!

...

...

...

...

...!

...

...

...

...!

...

...!

...

...

...

...!

...!

...

.

.

:

.











... ..!

...

... ..

... ..

... ..

... ..

...

...

...

...

...

...

...

...

...

.

...

( )

.

.

.

:

...

:

...!

:

( )

...





...

...!

...

...

( )

.

.

.

.

.

.

.

.

.

.

.

.

( )

...!

!

...!

...

...!

...!

-

-

-

-

-

-

-

-

-

-

-





...

...

...!

...!

.

...

...

...

...!

.

.

:

-

.

!

-

...

-

...!

-

:

-

.

.

...

.



( )

:

:

...!

...

:

...!

-

-

-



:

-

( )

:

-

...!

:

..!

-

-

...!

...

:

...!

-

:

...!

-

( )

...

...

...!

...

...

...

...!

...

...

...

...

.

.

.

.

.

.



( )

.

.

.

.

...

...

...

.

...

( )

.



...

...

-

.

!

-

...

-

.

:

...

...

...

-

( )

.

.

.

.

...

...

...

...

.

.

.

.

...!

...!

.

:

...

...

-

:

...!

-

-

.

...!

-

.

:

.

...

-

...

...

...

...

...

...!

...!

...

...

...

...

( )

...!

...

...

...

...

...

...!

...

( )

...

... ..

( )

... .. -

...! -

... .. -

... .. -

... .. -

...! -

... .. -

... .. -

... .. -

... .. -

...! ... -

... .. -



( )

...!

... ..

( )

...

...!

...

...

...

...

...!

...!

...!

:

-

:

-



( )

...

...

...

( )

...

...

...!

...

.  
 .  
 .  
 ... ..!  
 ...!  
 ...!  
 ... -  
 ... ..  
 : ..  
 ... -  
 .  
 :  
 ... ..  
 ... ..  
 ... -

( )

.  
 .

...

...

...

...

...!

...

.

...

.

.

.

.

.

.

.

.

.

:

...

...

...

-

.

.

.

.

...

...

.

.

.

...

.

.

.

.

