STATISTICAL SHORTS

In this problem, I am going to look into each different scenario with depth and justify my reasons for each of my assumptions. In addition, I am going to comment on how could each problem can edited so it is always false or always true.

1. It is just as likely to rain tomorrow as it is to rain the day after tomorrow.

This is always true.

2. In a school, there will be two people who share a birthday.

This statement is true if there are more than 366 people in the school. This is because every body has a different birthday. There are 365 days in an year however there are 366 days in a leap year. We must consider the fact that some people are born on leap years, and there is a slight possibility of someone being born on February 29th.

As we can see in this table:

Number of students	Probability of two people sharing the same birth day(%)
1	0
2	0.546448087431694
3	0.819672131147541
4	1.09289617486339
5	1.36612021857923
6	1.63934426229508
7	1.91256830601093
8	2.18579234972678
9	2.45901639344262
10	2.73224043715847
11	3.00546448087432
12	3.27868852459016
13	3.55191256830601
14	3.82513661202186
15	4.0983606557377
16	4.37158469945355
17	4.6448087431694
18	4.91803278688525
19	5.19125683060109
20	5.46448087431694
21	5.73770491803279
22	6.01092896174863
23	6.28415300546448
24	6.55737704918033

25	6.83060109289618
26	7.10382513661202
27	7.37704918032787
28	7.65027322404372
29	7.92349726775956
30	8.19672131147541
31	8.46994535519126
32	8.7431693989071
33	9.01639344262295
34	9.2896174863388
35	9.56284153005464
36	9.83606557377049
37	10.1092896174863
38	10.3825136612022
39	10.655737704918
40	10.9289617486339
41	11.2021857923497
42	11.4754098360656
43	11.7486338797814
44	12.0218579234973
45	12.2950819672131
46	12.568306010929
47	12.8415300546448
48	13.1147540983607
49	13.3879781420765
50	13.6612021857924
51	13.9344262295082
52	14.207650273224
53	14.4808743169399
54	14.7540983606557
55	15.0273224043716
56	15.3005464480874
57	15.5737704918033
58	15.8469945355191
59	16.120218579235
60	16.3934426229508
61	16.6666666666667
62	16.9398907103825
63	17.2131147540984
64	17.4863387978142
65	17.7595628415301
66	18.0327868852459
67	18.3060109289618
68	18.5792349726776
69	18.8524590163934

70	19.1256830601093
71	19.3989071038251
72	19.672131147541
73	19.9453551912568
74	20.2185792349727
75	20.4918032786885
76	20.7650273224044
77	21.0382513661202
78	21.3114754098361
79	21.5846994535519
80	21.8579234972678
81	22.1311475409836
82	22.4043715846995
83	22.6775956284153
84	22.9508196721311
85	23.224043715847
86	23.4972677595628
87	23.7704918032787
88	24.0437158469945
89	24.3169398907104
90	24.5901639344262
91	24.8633879781421
92	25.1366120218579
93	25.4098360655738
94	25.6830601092896
95	25.9562841530055
96	26.2295081967213
97	26.5027322404372
98	26.775956284153
99	27.0491803278689
100	27.3224043715847
101	27.5956284153005
102	27.8688524590164
103	28.1420765027322
104	28.4153005464481
105	28.6885245901639
106	28.9617486338798
107	29.2349726775956
108	29.5081967213115
109	29.7814207650273
110	30.0546448087432
111	30.327868852459
112	30.6010928961749
113	30.8743169398907
114	31.1475409836066

115	31.4207650273224
116	31.6939890710383
117	31.9672131147541
118	32.2404371584699
119	32.5136612021858
120	32.7868852459016
121	33.0601092896175
122	33.3333333333333
123	33.6065573770492
124	33.879781420765
125	34.1530054644809
126	34.4262295081967
127	34.6994535519126
128	34.9726775956284
129	35.2459016393443
130	35.5191256830601
131	35.792349726776
132	36.0655737704918
133	36.3387978142077
134	36.6120218579235
135	36.8852459016393
136	37.1584699453552
137	37.431693989071
138	37.7049180327869
139	37.9781420765027
140	38.2513661202186
141	38.5245901639344
142	38.7978142076503
143	39.0710382513661
144	39.344262295082
145	39.6174863387978
146	39.8907103825137
147	40.1639344262295
148	40.4371584699454
149	40.7103825136612
150	40.9836065573771
151	41.2568306010929
152	41.5300546448087
153	41.8032786885246
154	42.0765027322404
155	42.3497267759563
156	42.6229508196721
157	42.896174863388
158	43.1693989071038
159	43.4426229508197

160	43.7158469945355
161	43.9890710382514
162	44.2622950819672
163	44.5355191256831
164	44.8087431693989
165	45.0819672131148
166	45.3551912568306
167	45.6284153005465
168	45.9016393442623
169	46.1748633879781
170	46.448087431694
171	46.7213114754098
172	46.9945355191257
173	47.2677595628415
174	47.5409836065574
175	47.8142076502732
176	48.0874316939891
177	48.3606557377049
178	48.6338797814208
179	48.9071038251366
180	49.1803278688525
181	49.4535519125683
182	49.7267759562842
183	50
184	50.2732240437158
185	50.5464480874317
186	50.8196721311475
187	51.0928961748634
188	51.3661202185792
189	51.6393442622951
190	51.9125683060109
191	52.1857923497268
192	52.4590163934426
193	52.7322404371585
194	53.0054644808743
195	53.2786885245902
196	53.551912568306
197	53.8251366120219
198	54.0983606557377
199	54.3715846994536
200	54.6448087431694
201	54.9180327868852
202	55.1912568306011
203	55.4644808743169
204	55.7377049180328

205	56.0109289617486
206	56.2841530054645
207	56.5573770491803
208	56.8306010928962
209	57.103825136612
210	57.3770491803279
211	57.6502732240437
212	57.9234972677596
213	58.1967213114754
214	58.4699453551913
215	58.7431693989071
216	59.0163934426229
217	59.2896174863388
218	59.5628415300546
219	59.8360655737705
220	60.1092896174863
221	60.3825136612022
222	60.655737704918
223	60.9289617486339
224	61.2021857923497
225	61.4754098360656
226	61.7486338797814
227	62.0218579234973
228	62.2950819672131
229	62.568306010929
230	62.8415300546448
231	63.1147540983607
232	63.3879781420765
233	63.6612021857924
234	63.9344262295082
235	64.207650273224
236	64.4808743169399
237	64.7540983606557
238	65.0273224043716
239	65.3005464480874
240	65.5737704918033
241	65.8469945355191
242	66.120218579235
243	66.3934426229508
244	66.6666666666667
245	66.9398907103825
246	67.2131147540984
247	67.4863387978142
248	67.7595628415301
249	68.0327868852459

250	68.3060109289617
251	68.5792349726776
252	68.8524590163934
253	69.1256830601093
254	69.3989071038251
255	69.672131147541
256	69.9453551912568
257	70.2185792349727
258	70.4918032786885
259	70.7650273224044
260	71.0382513661202
261	71.3114754098361
262	71.5846994535519
263	71.8579234972678
264	72.1311475409836
265	72.4043715846995
266	72.6775956284153
267	72.9508196721311
268	73.224043715847
269	73.4972677595628
270	73.7704918032787
271	74.0437158469945
272	74.3169398907104
273	74.5901639344262
274	74.8633879781421
275	75.1366120218579
276	75.4098360655738
277	75.6830601092896
278	75.9562841530055
279	76.2295081967213
280	76.5027322404372
281	76.775956284153
282	77.0491803278689
283	77.3224043715847
284	77.5956284153005
285	77.8688524590164
286	78.1420765027322
287	78.4153005464481
288	78.6885245901639
289	78.9617486338798
290	79.2349726775956
291	79.5081967213115
292	79.7814207650273
293	80.0546448087432
294	80.327868852459

295	80.6010928961749
296	80.8743169398907
297	81.1475409836066
298	81.4207650273224
299	81.6939890710383
300	81.9672131147541
301	82.2404371584699
302	82.5136612021858
303	82.7868852459016
304	83.0601092896175
305	83.3333333333333
306	83.6065573770492
307	83.879781420765
308	84.1530054644809
309	84.4262295081967
310	84.6994535519126
311	84.9726775956284
312	85.2459016393443
313	85.5191256830601
314	85.792349726776
315	86.0655737704918
316	86.3387978142077
317	86.6120218579235
318	86.8852459016393
319	87.1584699453552
320	87.431693989071
321	87.7049180327869
322	87.9781420765027
323	88.2513661202186
324	88.5245901639344
325	88.7978142076503
326	89.0710382513661
327	89.344262295082
328	89.6174863387978
329	89.8907103825137
330	90.1639344262295
331	90.4371584699454
332	90.7103825136612
333	90.983606557377
334	91.2568306010929
335	91.5300546448087
336	91.8032786885246
337	92.0765027322404
338	92.3497267759563
339	92.6229508196721

340	92.896174863388
341	93.1693989071038
342	93.4426229508197
343	93.7158469945355
344	93.9890710382514
345	94.2622950819672
346	94.5355191256831
347	94.8087431693989
348	95.0819672131148
349	95.3551912568306
350	95.6284153005464
351	95.9016393442623
352	96.1748633879781
353	96.448087431694
354	96.7213114754098
355	96.9945355191257
356	97.2677595628415
357	97.5409836065574
358	97.8142076502732
359	98.0874316939891
360	98.3606557377049
361	98.6338797814208
362	98.9071038251366
363	99.1803278688525
364	99.4535519125683
365	99.7267759562842
366	100

-I calculated the probability of two people sharing the same birth day by dividing the number of students by 366 and multiplying it by 100 to find the percent.

To make this statement true, it should be like this:

In a school with more than 366 people, there will be two people who share a birthday.

To make this statement impossible, it should be like this:

In a school, with one or no people, there will be two people who share a birthday.

3. In a school, it will be someone's birthday every day.

There are 365 days in an year and 366 days. This is why there must be at least 365 people if everyday is somebody's birthday.

To make this statement impossible, the question should be rewritten like this:

In a school, with less than 365 people, it will be someone's birthday every day.

To make this statement true, it should be rewritten like this:

In a school, with more than 365 people, it will be someone's birthday every day.

4. A randomly selected person from London will live to a greater age than a randomly selected person from Calcutta.

The life expectancy of an individual greatly depends on where they live and their wealthiness. A person from a rich neighborhood in Calcutta is probably expected to live longer than a poor person in London. While a person from a really rich neighborhood in London is probably expected to live longer than a poor person in Calcutta.

This is because really rich person in Calcutta has more money to spend on better medication and sanitation than a poor person in London. On the other hand, a really poor person in Calcutta has less money to spend on better medication and sanitation than a really rich person in London;.

Therefore, to make the make the statement impossible or nearly impossible, the question should be edited to something like this:

A randomly selected person from a poor neighborhood in London will live to a greater age than a randomly selected person from a rich neighborhood in Calcutta.

To make the make the statement true or nearly true, the question should be edited to something like this:

A randomly selected person from a rich neighborhood in London will live to a greater age than a randomly selected person from a poor neighborhood in Calcutta.

5. If everyone in the class rolled two dice until someone threw a double six, there would be one winner.

To find the different possible permutations. The formula to find the total of different permutations with repetition is n^r 'n' is denoting the choices you have every time and r is denoting how many 'times do you choose them'.

People in class	Throws	Possibility of a double of 6(%
1	2	5.55555555555556
2	4	11.1111111111111
3	6	16.6666666666667
4	8	22.2222222222222

5	10	27.7777777777778
6	12	33.3333333333333
7	14	38.8888888888889
8	16	44.4444444444444
9	18	50
10	20	55.5555555555556
11	22	61.1111111111111
12	24	66.6666666666667
13	26	72.2222222222222
14	28	77.7777777777778
15	30	83.3333333333333
16	32	88.8888888888889
17	34	94.4444444444444
18	36	100
19	38	105.555555555556
20	40	111.111111111111
21	42	116.666666666667
22	44	122.222222222222
23	46	127.777777777778
24	48	133.333333333333
25	50	138.888888888889
26	52	144.444444444444
27	54	150
28	56	155.555555555556
29	58	161.111111111111
30	60	166.666666666667
31	62	172.222222222222
32	64	177.777777777778
33	66	183.333333333333
34	68	188.888888888889
35	70	194.444444444444
36	72	200
37	74	205.555555555556
38	76	211.111111111111
39	78	216.666666666667
40	80	222.222222222222
41	82	227.777777777778
42	84	233.333333333333
43	86	238.888888888889

To make the make the statement true or nearly true, the question should be edited to something like this:

If everyone in the class with 18 people rolled two dice until someone threw a double six, there would be one winner.

To make the make the statement impossible or nearly impossible, the question should be edited to something like this:

If everyone in the class with less than 18 people or more than 18 people rolled two dice until someone threw a double six, there would be one winner.

6. If I roll a die 100 times, I will get about the same number of 1s as 6s.

This is not true as a die has 6 possibilities;1, 2, 3, 4, 5 and 6. Since, 100 is not divisible by 6. 100 divided by 6 is 16 remainder 4. If we divide the remainder among all the numbers, 4/6, we find out that the probability for the same number of 1s and 6s is 2/3.

To make this statement true or nearly try, the question should be edited to something like this:

If I roll a die 600 times, I will get about the same number of 1s and 6s.

To make this statement impossible or near impossible, the question should be edited to something like this:

If I roll a die one time, I will get about the same number of 1s and 6s.

8. The mean, median and mode of a set of numbers can't all be the same.

This statement can be false for some sets however can be true for the other sets. For example, with the set, 1,2,2 and 3, the mode, median and mean are all 2. However, with the set, 1,2,3 and 4, the mode, median and mode are not the same.

To make the statement impossible, the question should be edited to something like this:

The mean, median and mode for 1,2,2 and 3 can't be all the same.

To make the statement true, the question should be edited to something like this:

The mean, median and mode for 1,2,3 and 4 can't be the same.

9. The mean cannot be less than both the median and the mode.

This statement is false for some sets such as 1,4,4 and 4 where the mean is 3.25 and the mode and the median is 4. However, this statement is not true for some sets such as 1,2,2 and 3 where the mean, mode and median are all the same.

To make this statement impossible we could say:

The mean for 1,4,4 and 4 is less than both the median and mode.

To make this statement true we could say:

The mean for 1,2,2 and 3 is less than both the median and mode.

10. Half of the students score less than an average mark.

This is extremely rare however students may score less than an average mark because they live in a poor country with many diseases, high pollution, bad teachers, poor government run schools or poor parents. If you are in a location where most students are susceptible to diseases such as malaria or typhoid, your brain will probably be more focused on resisting such dangerous diseases instead of focusing on studies which may lead to low IQ and a lack of focus on studies. High pollution means that the students have brain damages and don't grow really well. The school may recruit bad teachers which may be another reason for low IQ. For example, if the teachers don't teach the children basic skills such as basic arithmetic and alphabets. One other reason may be, the schools may be run by poor governments, where the country is really poor, corrupt or the government may prefer to spend more money to fund the military rather than the schools. In addition, the parents may be too poor to afford better schools whereas really rich parents can afford, good schools and if the student is really bad special tuitions and summer camps.

This issue can be looked at further depths is dependent on many factors, so it cannot really be expressed in a simple relationship. For example, Mongolia has a higher IQ compared to a United States although United States is a richer country, has a better health system and has less pollution compared to Mongolia.

11. Nobody scores higher than the average mark for the test.

This scenario really rare, almost close to impossible. However if the situation in the school is really bad like an extreme version of what I discussed in Scenario 10 than this can be possible.

12. In a game where you can only score an even number of points (0, 2, 10 or 50), the average score over a series of games must be an even number.

According to my table below, it is a rare chance that the average of a series of games will be an even number. I made a list of even numbers and another list of even numbers under the column 'Even number 1' and 'Even number 2' to get a bunch of random even numbers. Then I divided each number by a number of games to get the average. At the end, I found out that 3/20 of the averages were whole even numbers. Therefore, the probability of a number being both a whole

and even number is really rare however possible.

Even number 1	Even number 2	Total	Number of games	Average
2	10	12	1	12
4	12	16	2	8
6	14	20	3	6.6666666667
8	16	24	4	6
10	18	28	5	5.6
12	20	32	6	5.3333333333
14	22	36	7	5.1428571429
16	24	40	8	5
18	26	44	9	4.8888888889
20	28	48	10	4.8
22	30	52	11	4.7272727273
24	32	56	12	4.6666666667
26	34	60	13	4.6153846154
28	36	64	14	4.5714285714
30	38	68	15	4.5333333333
32	40	72	16	4.5
34	42	76	17	4.4705882353
36	44	80	18	4.4444444444
38	46	84	19	4.4210526316
40	48	88	20	4.4

REFERENCE SITES:

1) http://www.guardian.co.uk/science/2010/jun/30/disease-rife-countries-low-iqs
2) http://www.medpagetoday.com/PublicHealthPolicy/EnvironmentalHealth/15209
3) http://en.wikipedia.org/wiki/IQ_and_the_Wealth_of_Nations