

2014 USAMO/USAJMO Indices and Selection

April 10 , 2014

Due to late additions, updates, and changes to the final invitation list some final USAMO and USAJMO counts may change by a few individuals which will not be reflected in this document. All statistics and counts using the AIME should remain unchanged.

1 Statistics for 2014 AIME I and 2014 AIME II

This section contains statistics summarizing selected outcomes for the 2014 AMC contests.

As of April 6, 2014, Table 1 contains the following descriptive statistics for *students in the US, US territories, and Canada* taking the 2014 AIME I and 2014 AIME II. (Note: As of April 10, these statistics include all but a few (unknown number) US and Canada schools that have not yet returned AIME contests for scoring. By this time, we expect these schools might not even return their materials at all! Other than those omitted students, the statistics *do not* include students outside of North America. The omissions should not affect the North America statistics. Comprehensive world-wide statistics are reported on the AMC website.

For students in the US and the Canada taking a 2014 AMC 12 and then taking the 2014 AIME I and 2014 AIME II, Table 2 has the following descriptive statistics: (Note that this includes a few students who have a 12 score which is not qualifying while qualifying on the other AMC 12 or from the AMC 10.)

For students in the US and the Canada taking a 2014 AMC 10 and then taking the 2014 AIME I and 2014 AIME II, Table 3 has the following

	2014 AIME I	2014 AIME II
<i>N</i>	4017	1386
Mean	4.90	4.90
StdDev	2.48	2.40
Q1	3.0	3.0
Med	5.0	5.0
Q3	6.0	6.0
US Top 10%	8.0	8.0
US Top 2.5%	10.0	10.0
US Top 1.0%	11.0	11.0

Table 1: North America 2014 AIME score statistics

	2014 AIME I	2014 AIME II
12A <i>N</i>	1959	704
AIME Mean	4.7	5.1
12A Mean	101.5	103.0
12A Median	97.5	100.5
12A Q3	105.0	105.0
12B <i>N</i>	849	507
Mean	5.7	5.5
12B Mean	107.2	104.9
12B Median	106.5	105.0
12B Q3	112.5	112.5

Table 2: North America 2014 AMC 12 Takers with an AIME score

	2014 AIME I	2014 AIME II
10A N	1158	458
AIME Mean	5.0	4.7
10A Mean	129.3	128.5
10A Median	124.5	130.5
10A Q3	135.0	135.0
10B N	532	293
AIME Mean	5.3	4.8
10B Mean	125.7	121.4
10B Median	126	123
10B Q3	132	129

Table 3: North America 2014 AMC 10 Takers with an AIME score

descriptive statistics: (Note that this includes a few students who have a 10 score which is not qualifying while qualifying on the other AMC 10 or from the AMC 12.) descriptive statistics:

The total of all US and Canada students taking AIME I and scored by April 7, 2014 is 4017. Note the sum of all AIME I takers in these two cross-tabulations is 4498 because of the double-counting of students taking 10A-10B, 12A-10B, 10A-12B, 12A-12B combinations. The over-counting is 481 students over the four combinations. The total of all US and Canada students taking AIME II and scored by April 7, 2014 is 1386. The sum of all AIME II takers in these two cross-tabulations is 1962 because of the double-counting of 576 students taking 10A-10B, 12A-10B, 10A-12B, 12A-12B combinations.

2 Selection

2.1 USAMO Selection

The top 261 scores have a lowest index score of 211.5. The minimum AIME score in this group is 8, with only 4 of them. The USAMO qualifiers group has 38 AIME scores of 9. This preliminary USAMO qualifiers group has 16 AMC 10 takers with an AMC 12 based index in this USAMO selection group. These 16 are excluded in the later USAJMO selection.

I used the AIME School State to identify what state the USAMO and

USAJMO qualifiers were from. There were 42 states represented. After adding in 5 qualifiers from states not already represented (see below), the total number of USAMO invitees is 266. The USAMO qualifiers group has 1 self-identified 13th-grader (appears to be foreign-exchange student.) The USAMO qualifiers group has 104 self-identified 12-graders. The USAMO qualifiers group has 100 self-identified 11th-graders. The USAMO qualifiers group has 44 self-identified 10th-graders. The USAMO qualifiers group has 10 self-identified 9th-graders. There are 6 self-identified 8th-graders. There is one self-identified 7th-grader and 1 self-identified 4th grader. This is a total of 266. Note also that there are 60 identified in grades 10 and below, and 16 have an identified AMC 10 score, so 44 either took 12A or 12 B or took both. There are 229 males, 25 females, 12 unknown. There are 202 who qualified through the AIME I, and 64 who qualified through the AIME II. That is a ratio of 3.15. The ratio of US and Canada AIME I takers to AIME II takers is $4017/1398 = 2.87$. Out of the 246 students (from the 261 initially selected) taking AMC 12 only, the number who qualified through the 2014 AMC 12 A is 185, the number who qualified through the AMC 12 B is 129 (and 1 qualified only on the A, but not on the B, although the student took the 12B). This means 68 qualified through one 12-contest score alone, and 178 qualified through both 12-contests.

2.2 USAJMO Selection

For the USAJMO, I selected from the remainder of AIME takers after eliminating the USAMO selection. This means that the USAMO qualifiers are not selected. As a consequence, I have automatically eliminated the 16 students with an AMC 10 qualifying score. I sorted on AMC 10 Index. The top 235 scores have a lowest index of 211.0 with a 21-way tie at 211.0. I then double-checked that all students in this group of 235 students with AMC 12 based indices indeed have AMC 12 based indices strictly less than 211.5. Several students later were moved or eliminated to the USAMO list because of later information or duplicated lines. Three students were added from states not already represented. The final number of students invited to the JMO is 231.

The minimum AIME score among students with an index greater than 211.0 is 7, achieved by 47 students. To still qualify for the USAJMO, each had to get a score of 141.0 or better on the AMC 10 (either A or B).

I used the AIME School State to identify what state the $261 + 235 = 496$ qualifiers were from. Together the USAMO qualifiers and the USAJMO

qualifiers represent 41 states, leaving 14 “states” not represented. (We also consider District of Columbia, and the territories of Guam, Puerto Rico, American Samoa, Virgin Islands as “states”, although there may be no participation in some of the territories.)

To the USAJMO I added in 3 students from states not already represented, for a final total of 231. This group of 231 students has 26 females, 199 males and 6 who did not report a gender. The USAJMO qualifiers group contains 98 10th graders, 76 9th graders, 45 8th graders, 12 7th graders and therefore 7 either did not report a grade or are in grades 6 and below.

The original group of 238 USAJMO qualifiers group contains 222 who took an A-date contest. Of those, 7 took the AMC 12 A. The group of 238 USAJMO qualifiers group contains 161 who took a B-date contest. Of those, 33 took the AMC 12 B. The USAJMO qualifiers group necessarily contains 7 who took a 12 A and 10 B combination (but because this is USAJMO selection, did not score sufficiently high on the 12 A to qualify for the USAMO) and 32 students who took a 10A and 12 B combination (and did not score sufficiently high on the AMC 12 B to qualify for the USAMO.)

The final USAJMO qualifiers group contains 173 who qualified through the AIME I, and 58 who qualified through the AIME II. That is a ratio of 2.98. The ratio of all qualifiers for USAMO and USAJMO through AIME I to all qualifiers for USAMO and USAJMO through AIME II is $(202 + 173)/(64 + 58) = 3.07$. The ratio of US and Canada AIME I takers to AIME II takers is $4017/1398 = 2.87$.

3 Comparison of AIME Difficulty Vectors

3.1 Item Difficulty Vectors in 2014

From the table of Item Difficulty by Contest AIME I, 2014 (total number of students is 4033, so includes almost exclusively the 4017 North American students) I took the percentage of students who answered each problem correctly. The Item Difficulty chart is in the AIME I statistics at the AMC web page, but I repeat and rearrange the results in the tables below:

1	2	3	4	5	6	7	8
78.68%	91.20%	62.16%	52.07%	54.72%	42.80%	11.78%	44.46%
9	10	11	12	13	14	15	
17.28%	7.56%	13.66%	5.33%	1.98%	2.88%	1.91%	

The Difficulty Order Ranking for 2014 AIME I is:

2	1	3	5	4	8	6	9
91.20%	78.68%	62.16%	54.72%	52.07%	44.46%	42.80%	17.28%
11	7	10	12	14	13	15	
13.66%	11.83%	7.56%	5.23%	2.88%	1.98%	1.91%	

The 2014 AIME II Difficulty Order Ranking is:

4	3	1	7	6	2	8	10
91.08%	88.18%	80.08%	56.21%	43.84%	37.93%	24.58%	17.24%
14	5	15	9	11	12	13	
11.93%	11.06%	10.02%	7.88%	6.35%	5.25%	4.27%	

3.2 Item Difficulty Vectors in 2013

From the table of Item Difficulty by Contest AIME I, 2013 (total number of students is 4005, so includes almost exclusively the 4017 North American students) I took the percentage of students who answered each problem correctly. The Item Difficulty chart is in the AIME I statistics at the AMC web page, but I repeat and rearrange the results in the tables below:

1	2	3	4	5	6	7	8
88.49%	43.82%	82.90%	70.84%	11.49%	43.30%	39.85%	22.77%
9	10	11	12	13	14	15	
27.24%	6.42%	20.77%	16.80%	6.12%	2.10%	3.02%	

The Difficulty Order Ranking for 2012 AIME I is:

1	3	4	2	6	7	9	8
88.49%	82.90%	70.84%	43.82%	43.30%	39.85%	27.24%	22.77%
11	12	5	10	13	15	14	
20.77%	16.80%	11.49%	6.42%	6.12%	3.02%	2.10%	

Then for 2013 AIME II, I did the same. However, because of the time when I did them, these are fall *all* scored AIME II participating students, (not just in North America.) The 2012 AIME II Item Difficulty chart is:

1	2	3	4	5	6	7	8
86.13%	81.18%	73.88%	51.12%	64.82%	50.49%	79.53%	49.75%
9	10	11	12	13	14	15	
12.04%	16.75%	7.79%	2.46%	32.41%	28.20%	9.87%	

The 2013 AIME II Difficulty Order Ranking is:

1	2	7	3	5	4	6	8
86.13%	81.18%	79.53%	73.88%	64.82%	51.12%	50.49%	49.75%
13	14	10	9	15	11	12	
32.41%	28.20%	16.75%	12.04%	9.87%	7.79%	2.46%	

3.2.1 Comparison of Difficulty Vectors in 2012

The corresponding Item Difficulty statistics for 2012 AIME I is

1	2	3	4	5	6	7	8
74.49%	89.95%	42.91%	46.26%	57.53%	34.02%	72.72%	23.71%
9	10	11	12	13	14	15	
21.94%	15.61%	2.81%	15.77%	3.73%	7.46%	2.54%	

The Difficulty Order Ranking for 2012 AIME I is:

2	1	7	5	4	3	6	8
89.95%	74.49%	72.72%	57.53%	46.26%	42.91%	34.04%	23.71%
9	12	10	14	13	11	15	
21.94%	15.77%	15.64%	7.46%	3.73%	2.81%	2.54%	

Then for 2012 AIME II, I did the same. However, because of the time when I did them, these are universal, out of *all* AIME II participating students, (not just in North America.) The 2012 AIME II Item Difficulty chart is:

1	2	3	4	5	6	7	8
84.73%	92.59%	68.44%	39.00%	89.11%	18.03%	16.37%	13.40%
9	10	11	12	13	14	15	
42.29%	46.03%	43.14%	14.40%	15.44%	4.51%	4.70%	

The 2012 AIME II Difficulty Order Ranking is:

2	5	1	3	10	11	9	4
92.59%	89.11%	84.70%	68.44%	46.03%	43.14%	42.29%	39.0%
6	7	13	12	8	15	14	
18.3%	16.37%	15.44%	14.40%	13.40%	4.70%	4.51%	

3.3 Some Comparison Vectors of AIME Difficulty

The Difficulty Order Ranking for 2011 AIME I is:

1	2	6	9	5	3	11	15
74.34%	44.95%	31.93%	28.89%	27.30%	25.49%	11.04%	9.23%
7	4	8	10	12	14	13	
8.76%	7.86%	7.42%	3.74%	2.15%	1.62%	0.70%	

The Difficulty Order Ranking for 2011 AIME II is:

2	4	3	5	6	1	8	9
67.26%	60.92%	58.12%	48.84%	46.11%	43.24%	37.58%	23.94%
14	7	10	12	11	13	15	
20.80%	18.26%	15.59%	14.32%	12.27%	1.85%		

3.3.1 Older Comparison Vectors of AIME Difficulty

2010 Combined AIME I and AIME II: (All available data was combined for the two AIMEs, so this is not perfect comparison.)

2	4	3	5	6	1	8	9
67.26%	60.92%	58.12%	48.84%	46.11%	43.24%	37.58%	23.94%
14	7	10	12	11	13	15	
22.47%	20.80%	18.26%	15.59%	14.32%	12.27%	1.85%	

2009 Combined AIME I and AIME II: (All available data was combined for the two AIMEs, so this is not perfect comparison.)

3	2	1	4	7	8	6	5
68.15%	57.85%	55.05%	47.54%	30.38%	29.30%	22.21%	20.11%
9	10	11	13	14	12	15	
19.64%	16.19%	15.46%	8.19%	7.76%	3.50%	1.46%	