Refer a Friend Program

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August 16, 2019

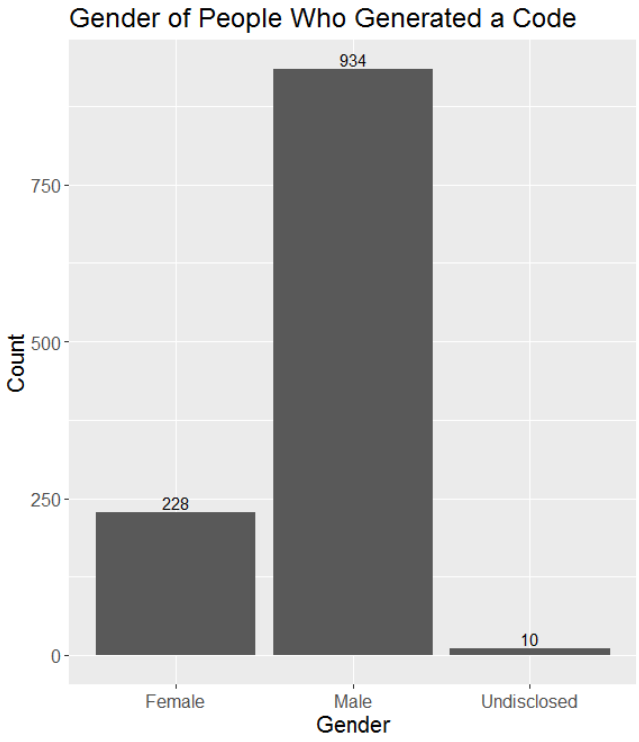
The goal of the Refer a Friend program is to encourage people who have never held a fishing, hunting, or wildlife license to buy one. The program works by first having a license holder with a Go Outdoors Virginia account generate a referral code. The license holder then gives the code to a friend who enters it at checkout when purchasing their first license. Both parties are incentivized through gifts such as a hat or coffee mug, as well as a 10% off coupon code for Green Top Hunting and Fishing.

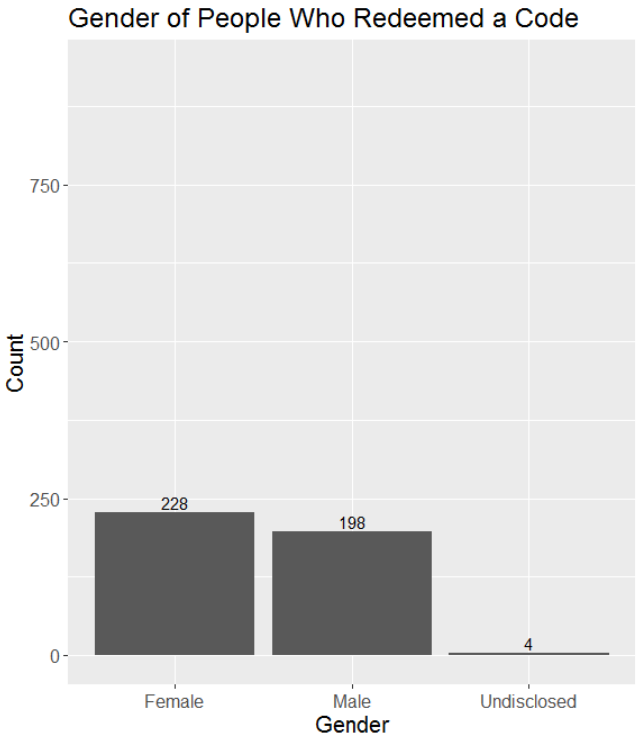
Fishing

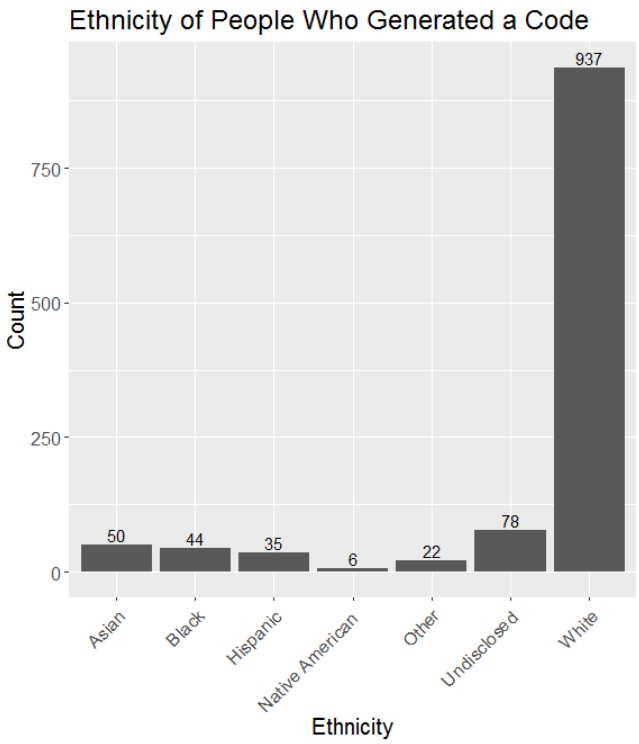
Beginning April 12, 2018, there were 430 code redemptions and 1,172 code generations over the duration of the event. Two years prior to the start of the program, between April 12, 2016 and April 12, 2018, the code generators accounted for 3,048 licenses purchased by 798 unique customer ID numbers. During the same period, 9 unique code redeemers purchased 14 licenses, 3 of which were temporary. In the year following the start of the event (April 12, 2018 to April 12, 2019), 1,019 unique code generators purchased 2,578 licenses, while 430 unique code redeemers purchased 552 licenses. Of the 552 licenses purchased by code redeemers, 88 were non-resident licenses, 39 were hunting related, 444 were fishing related (330 freshwater, 33 saltwater, 81 fresh/salt), 66 were access permits, and 6 were lifetime licenses. A full breakdown of the licenses purchased by code redeemers is shown in the table below.

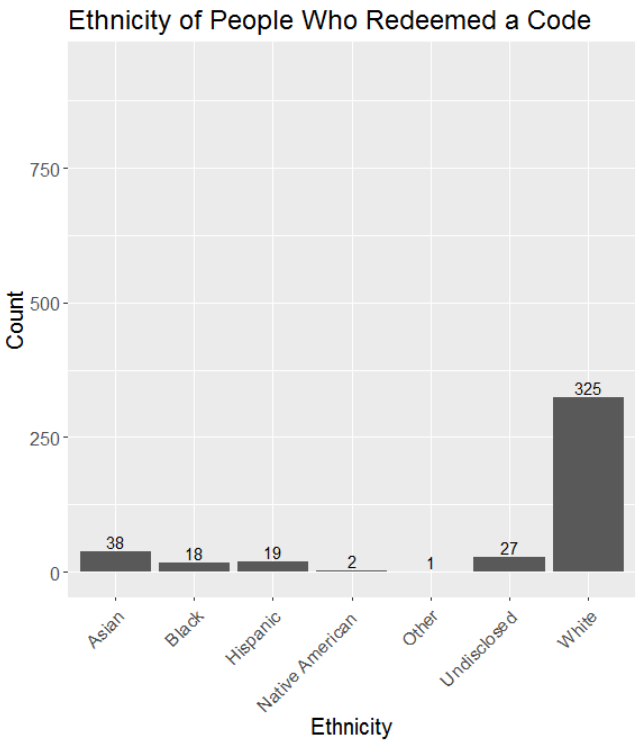
Licenses Purchased by Code Redeemers			
License	**Amount**	**License**	**Amount**
101	3	**103**	3
104	1	**112**	1
113	12	**119**	3
129	3	**161**	12
162	1	**167**	1
335	7	**353**	198
354	15	**355**	22
356	2	**357**	23
358	26	**359**	5
360	25	**371**	4
461	8	**463**	1
472	33	**475**	1
480	1	**491**	4
611	15	**612**	3
613	2	**614**	9
615	1	**651**	1
701	73	**702**	4
703	3	**704**	1
CMF	2	**FCP**	7
FR60	1	**FR64**	1
FR65	1	**HR60**	1
MCP	5	**SR60**	1
SR65	1	**SRP**	5

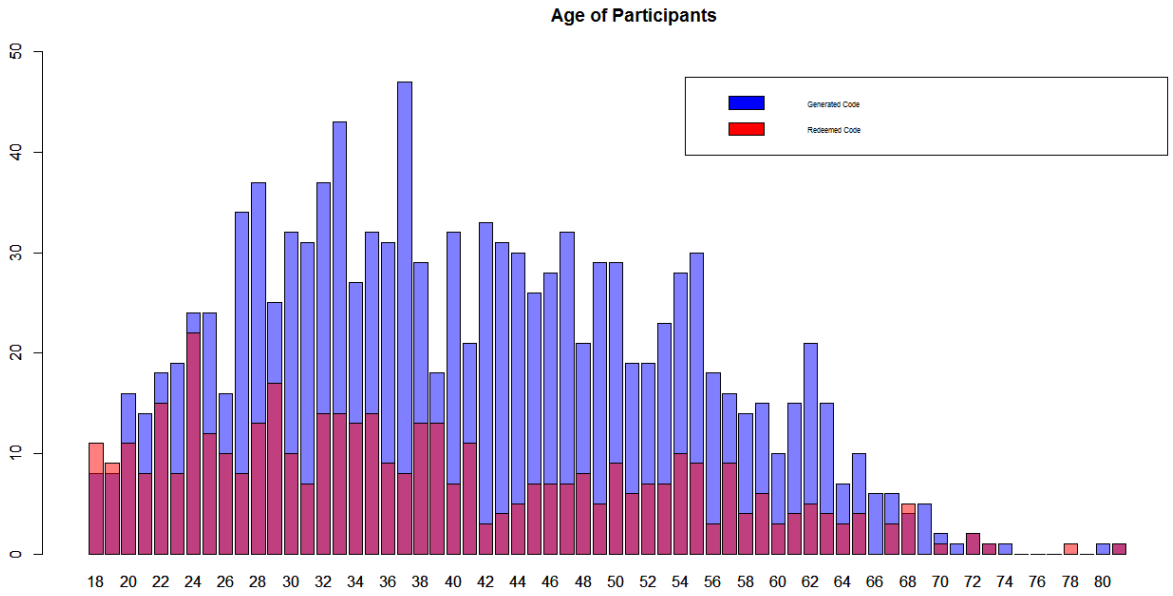
Demographics





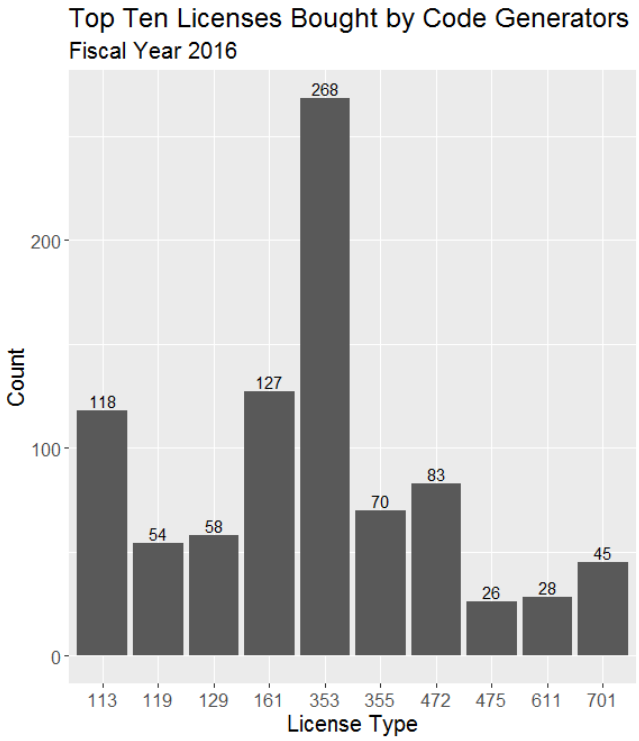


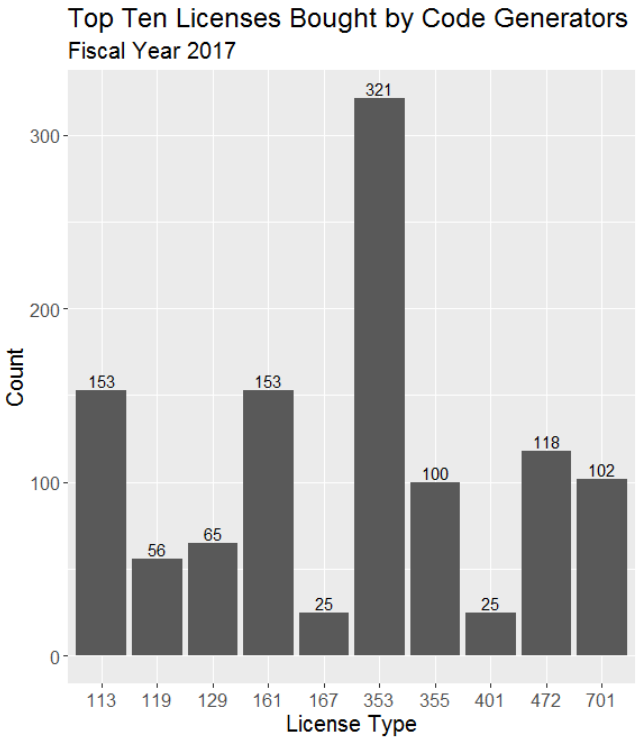


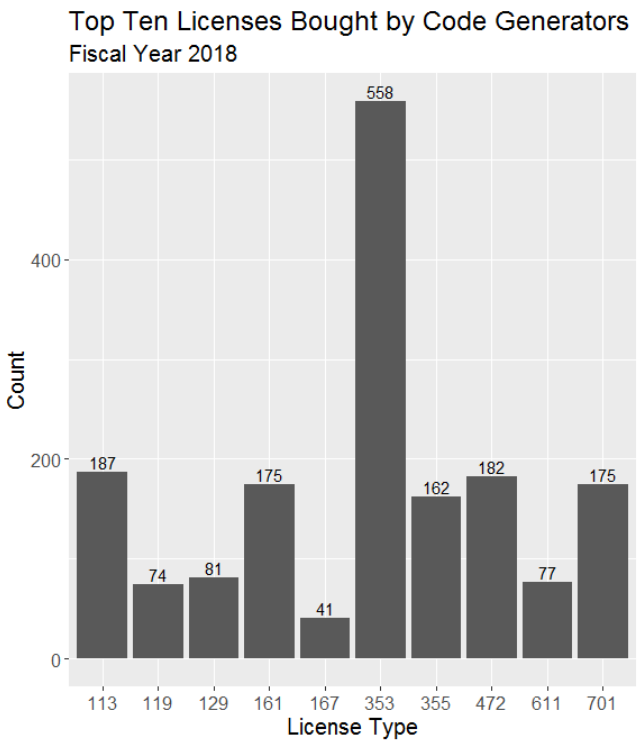


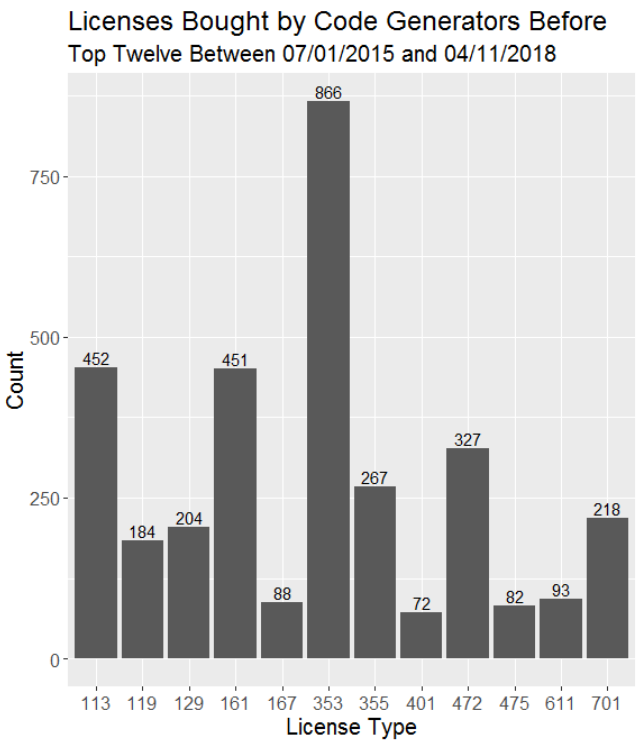
Group	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Generated	18	31	40	41.1	50	81
Redeemed	18	27	35	38.3	49	81

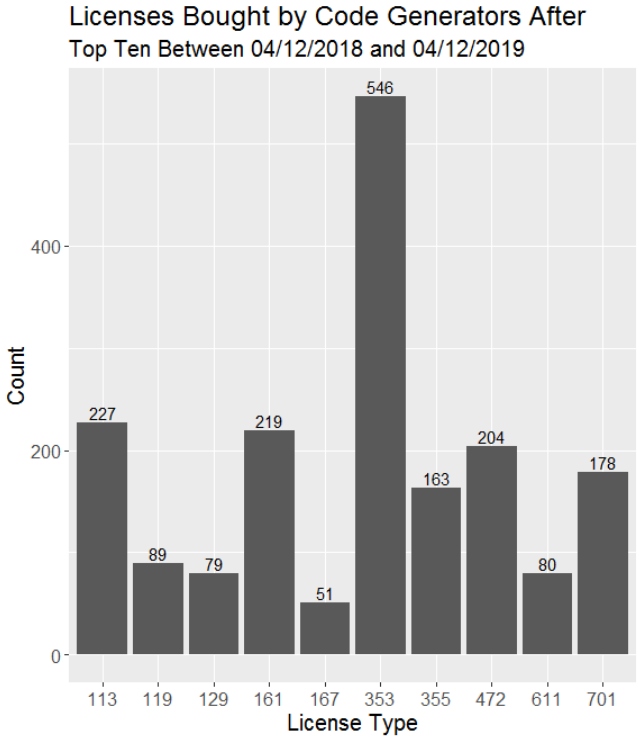
Licenses Purchased

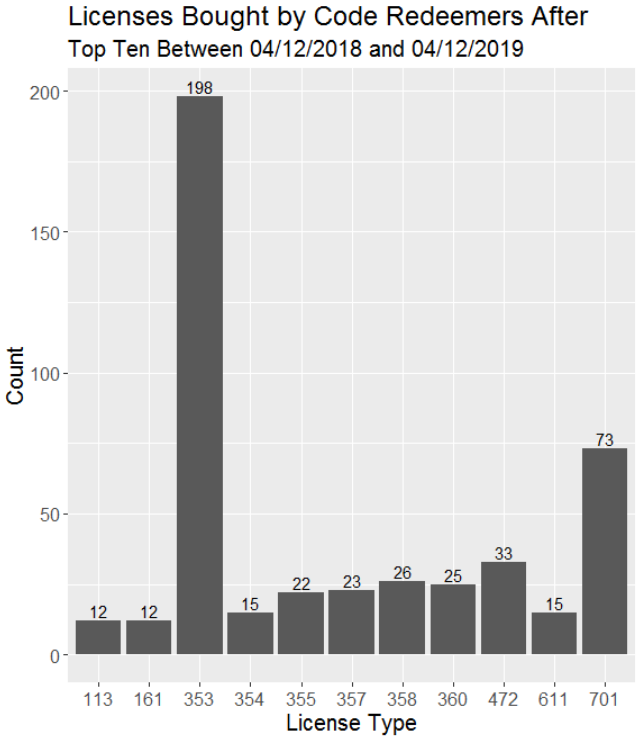




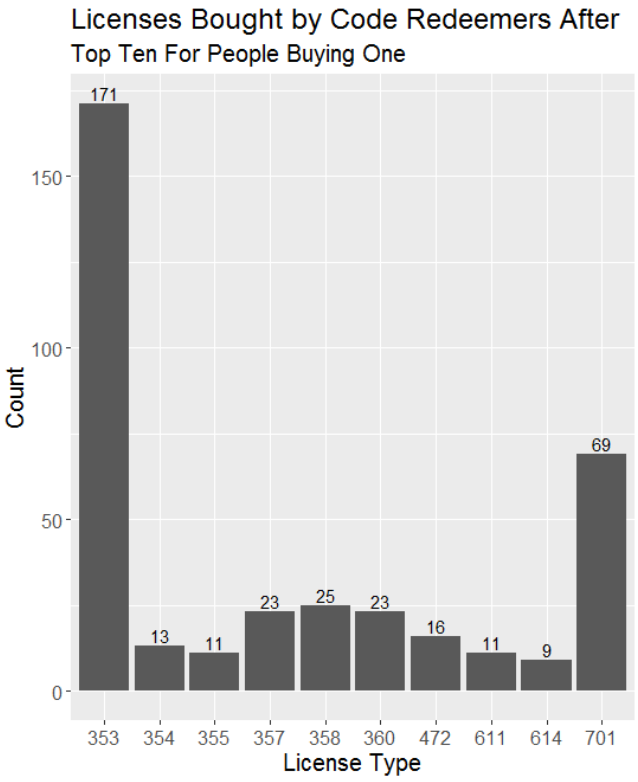

Top Ten Licenses Bought by Code Generators
Fiscal Year 2018
Count
License Type
0
200
400
187
74
81
175
41
558
162
182
77
175
113
119
129
161
167
353
355
472
611
701


Licenses Bought by Code Generators Before
Top Twelve Between 07/01/2015 and 04/11/2018
Count
License Type
0
250
500
750
452
184
204
451
88
866
267
72
327
82
93
218
113
119
129
161
167
353
355
401
472
475
611
701


Licenses Bought by Code Generators After
Top Ten Between 04/12/2018 and 04/12/2019
Count
License Type
0
200
400
227
89
79
219
51
546
163
204
80
178
113
119
129
161
167
353
355
472
611
701

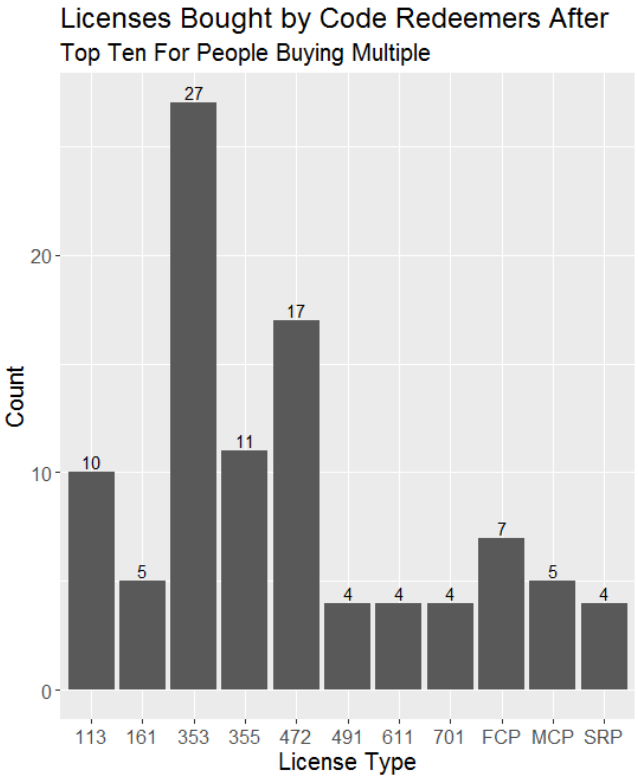

Licenses Bought by Code Redeemers After
Top Ten Between 04/12/2018 and 04/12/2019
Count
License Type
0
50
100
150
200
12
12
198
15
22
23
26
25
33
15
73
113
161
353
354
355
357
358
360
472
611
701

People Who Only Bought One License



License	Amount	License	Amount
101	1	**103**	1
104	1	**113**	2
119	1	**129**	2
161	7	**335**	7
353	171	**354**	13
355	11	**357**	23
358	25	**359**	5
360	23	**371**	4
461	6	**463**	1
472	16	**611**	11
612	3	**613**	2
614	9	**651**	1
701	69	**702**	4
703	3	**704**	1
CMF	2	**FR60**	1
FR64	1	**SR65**	1
SRP	1		

People Who Bought Multiple Licenses



License	Amount	License	Amount
101	2	**103**	2
112	1	**113**	10
119	2	**129**	1
161	5	**162**	1
167	1	**353**	27
354	2	**355**	11
356	2	**358**	1
360	2	**461**	2
472	17	**475**	1
480	1	**491**	4
611	4	**615**	1
701	4	**FCP**	7
FR65	1	**HR60**	1
MCP	5	**SR60**	1
SRP	4		

Statistical Testing

The purpose of this statistical test is to determine whether the group that generated codes for the Refer a Friend program purchased certain licenses during fiscal years 2016-2019 at a higher rate than the general population of license buyers in the same time period. This was accomplished by determining the total number of each license type purchased by the code generators and the rest of the license purchasing population, then dividing that number by the total number of licenses purchased by each group to arrive at a percentage for each license type. These percentages were then used to calculate the percent difference between both groups, with the overall percentage serving as the control group. The formula used for this calculation was: $\frac{\%Gen - \%Overall}{\%Overall}$.

Following these calculations, the code generators and the overall population were each divided into two groups of "bought" and "not bought", resulting in a two by two grid of categorical data on which we ran a Chi-square test. The group percentages, percent differences, and p-values associated with the tests are reported in the table below. We use an $\alpha = 0.05$ significance level, and notice that there are five license types with positive lift and significant p-values from the Chi-square test: **353**, **355**, **357**, **472**, and **701**. This tells us that the code generators accounted for a statistically significant higher percentage of people from those license types than we would expect from random chance alone. Since this program targeted current anglers, it follows that people holding the most common fishing licenses, as well as the most common access permit, would be present in higher concentrations. It is also worth pointing out that the code generators accounted for a statistically significant lower percentage of purchases for the two hunting specific licenses, **113** and **161**.

License	% Generators	% Overall	% Lift	P-Value
101	0.94%	1.00%	-6.4%	0.6496
113	9.82%	11.61%	-15.5%	***<0.001***
161	9.85%	13.43%	-26.7%	***<0.001***
353	23.31%	16.95%	+37.7%	***<0.001***
354	1.30%	1.26%	+3.72%	0.7754
355	6.94%	4.08%	+69.9%	***<0.001***
357	0.86%	0.46%	+87.7%	***<0.001***
401	1.76%	1.55%	+13.14%	0.1964
472	8.35%	7.25%	+15.2%	***<0.001***
475	1.94%	2.02%	-4.02%	0.6708
701	6.89%	3.33%	+107.1%	***<0.001***

***Statistically significant at <0.001 level

Next, we are interested in the difference in the mean number of years the code generators purchased each license type compared to the general license purchasing population during the same four year period as above (2016-2019). We begin by taking five samples of 1,172 unique Customer ID numbers from the general population group that bought at least one of license types **101**, **353**, **355**, or **357**. Then, the number of years each Customer ID number purchased a specific license during the stated time period is found and the mean number of years is calculated for each license type with the mean of the five means taken for the sample groups. Next, the difference between code generators and general population is taken, and a two sample t-test is performed to determine if the difference in means is statistically significant at the $\alpha = 0.05$ level. The two license types with positive, statistically significant differences are **701** and **354**, indicating that between 2016 and 2019, the code generators, on average, purchased the Resident State Fresh/Saltwater Fishing and Non-Resident State Freshwater Fishing licenses more often than the general license purchasing population.

Generators: Number of Years Purchased out of Four						
License	**Total**	**1 Year**	**2 Years**	**3 Years**	**4 Years**	**Mean**
101	176	16	6	7	2	1.84
113	612	61	56	49	73	2.56
161	627	65	52	46	80	2.58
353	1494	301	212	159	73	2.01
354	83	21	15	4	5	1.84
355	453	114	64	37	25	1.89
357	55	31	9	2	0	1.31
401	109	26	11	11	7	1.98
472	524	102	65	48	37	2.08
475	123	31	13	10	9	1.95
701	447	136	77	39	10	1.71

Mean Number of Years Purchased out of Four				
License	**Mean Generators**	**Mean Overall**	**Difference**	**P-Value**
101	1.839	2.518	-0.680	**0.0041**
113	2.561	2.534	+0.027	0.7964
161	2.580	2.622	-0.042	0.6825
353	2.005	2.001	+0.004	0.9270
354	1.844	1.000	+0.844	***<0.001***
355	1.888	1.919	-0.032	0.7078
357	1.310	1.313	-0.003	0.9788
401	1.981	2.166	-0.184	0.3926
472	2.079	2.303	-0.223	*0.0190*
475	1.952	2.325	-0.372	+0.0879+
701	1.706	1.362	+0.344	**0.0037**

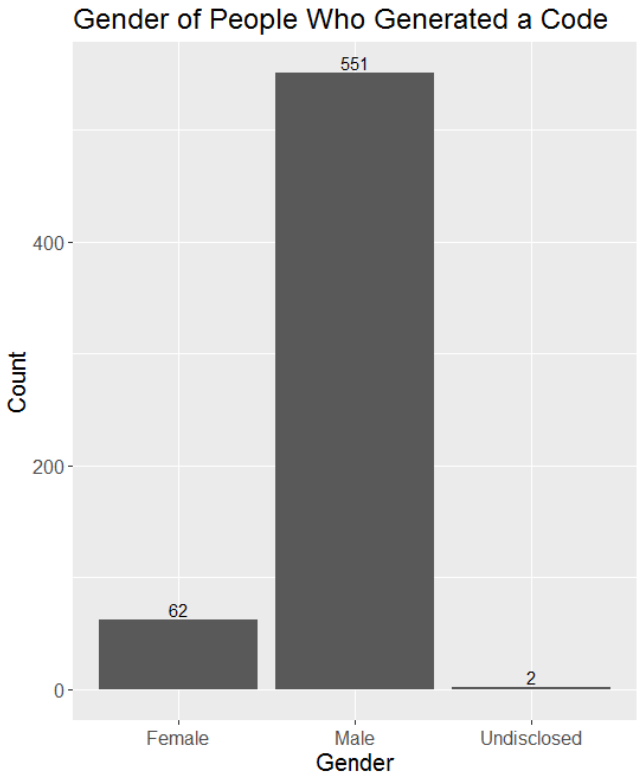
***Statistically significant at <0.001 level
**Statistically significant at 0.001-0.01 level
*Statistically significant at 0.01-0.05 level
+Statistically significant at 0.05-0.1 level

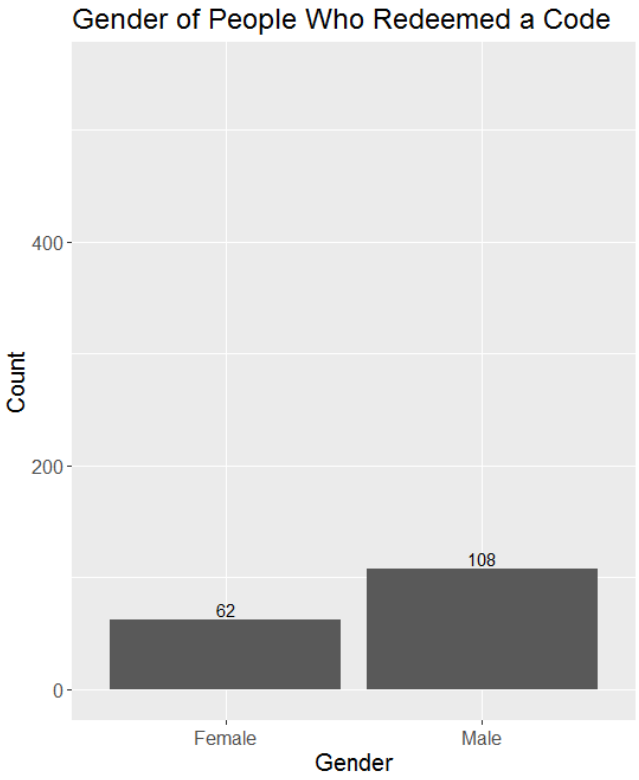
Hunting

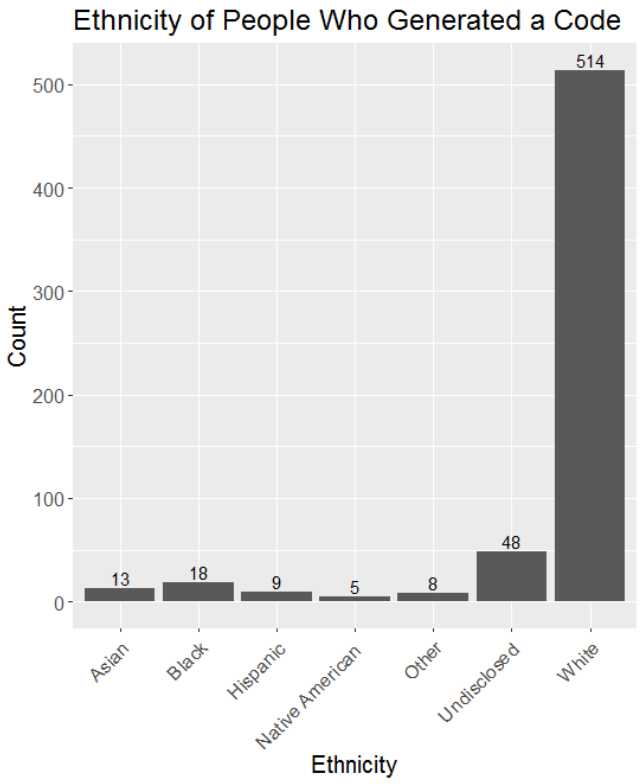
Beginning September 6, 2018, there were 170 code redemptions and 615 code generations over the duration of the event. Two years prior to the start of the program, between September 6, 2016 and September 6, 2018, the code generators accounted for 3,224 licenses purchased by 493 unique customer ID numbers. During the same period, there were zero licenses purchased by the group that would go on to become code redeemers. In the year following the start of the event (September 6, 2018 to September 6, 2019), 539 unique code generators purchased 1,731 licenses, while 170 unique code redeemers purchased 309 licenses. Of the 309 licenses purchased by code redeemers, 46 were non-resident licenses, 166 were hunting related (29 apprentice), 105 were fishing related (77 freshwater, 9 saltwater, 19 fresh/salt), 35 were access permits, and 2 were lifetime licenses. A full breakdown of the licenses purchased by the code redeemers is shown in the table below.

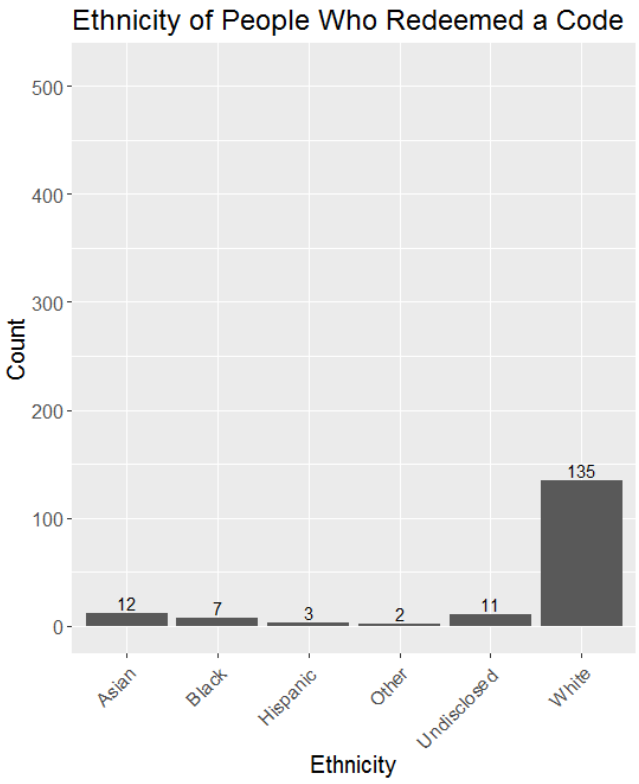
Licenses Purchased by Code Redeemers			
License	**Amount**	**License**	**Amount**
101	3	**103**	26
104	3	**111**	1
112	6	**113**	40
114	6	**119**	5
120	1	**122**	3
129	6	**145**	1
161	46	**162**	8
167	2	**335**	1
353	37	**354**	3
355	10	**356**	2
357	4	**358**	4
359	5	**360**	9
371	1	**401**	5
461	2	**463**	1
472	15	**475**	7
491	1	**611**	7
613	1	**701**	16
703	2	**716**	1
CMF	1	**FCP**	4
FR65	1	**MCP**	6
SR65	1	**SRP**	5

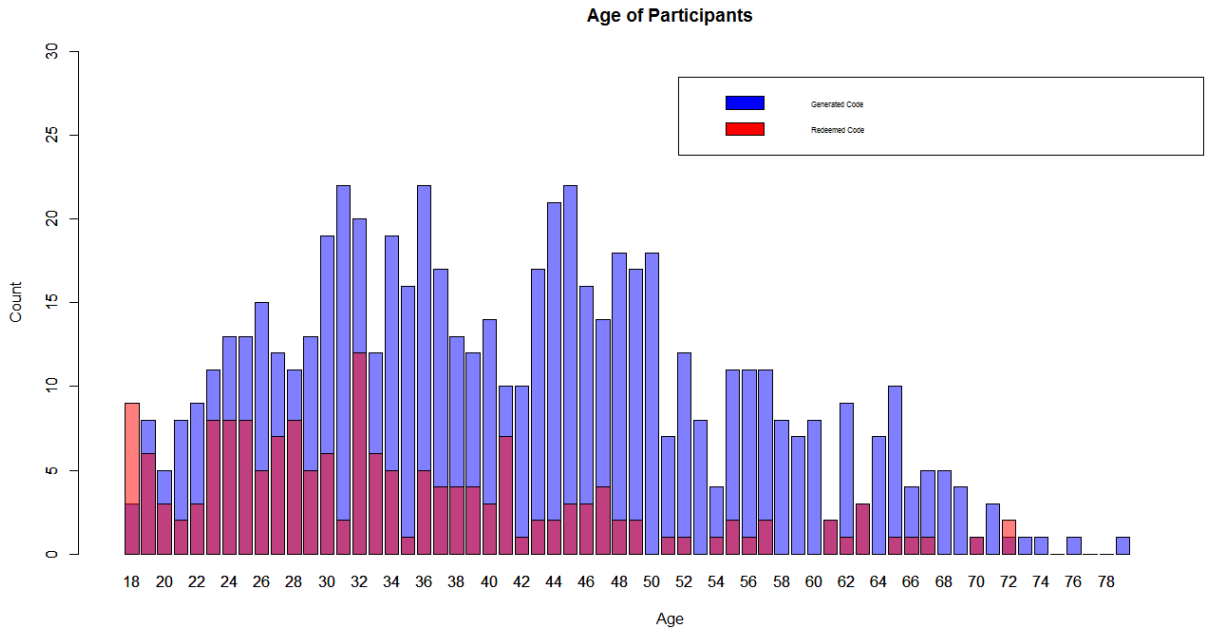
Demographics





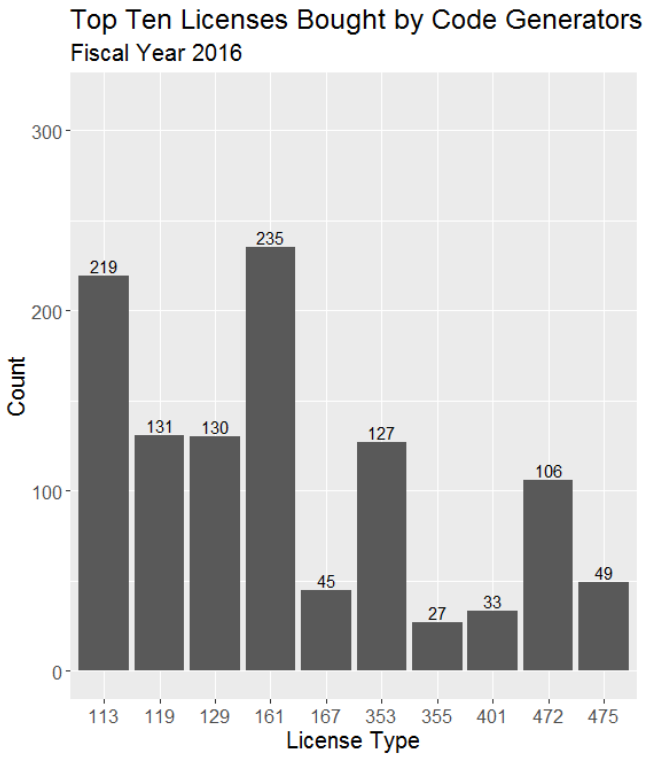


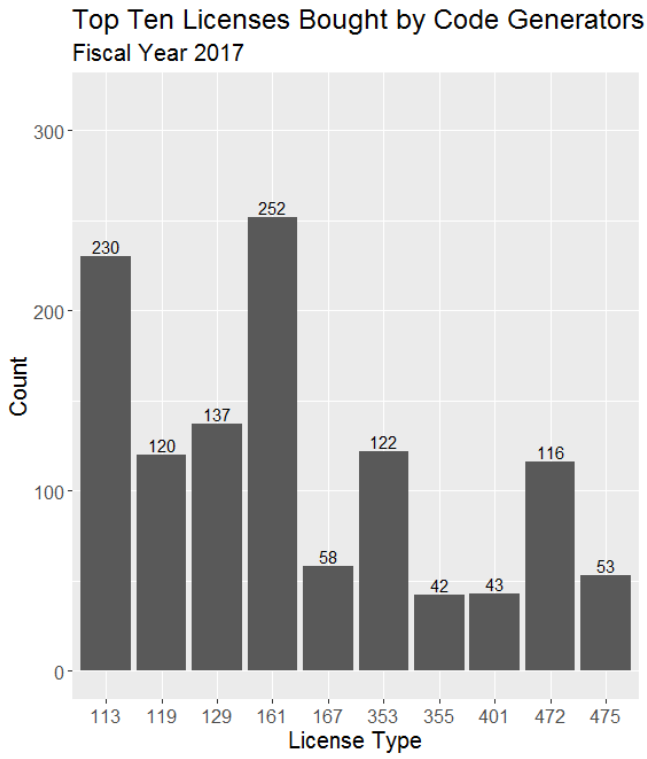


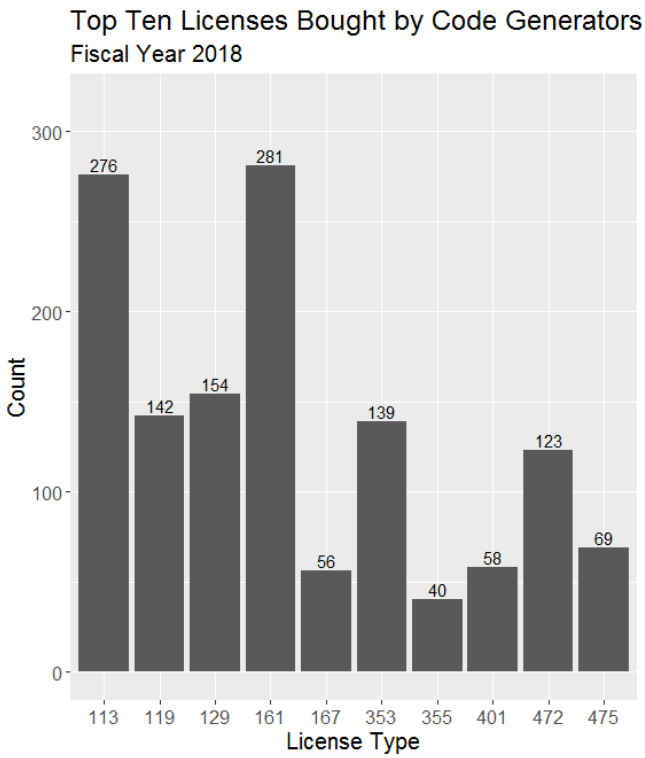


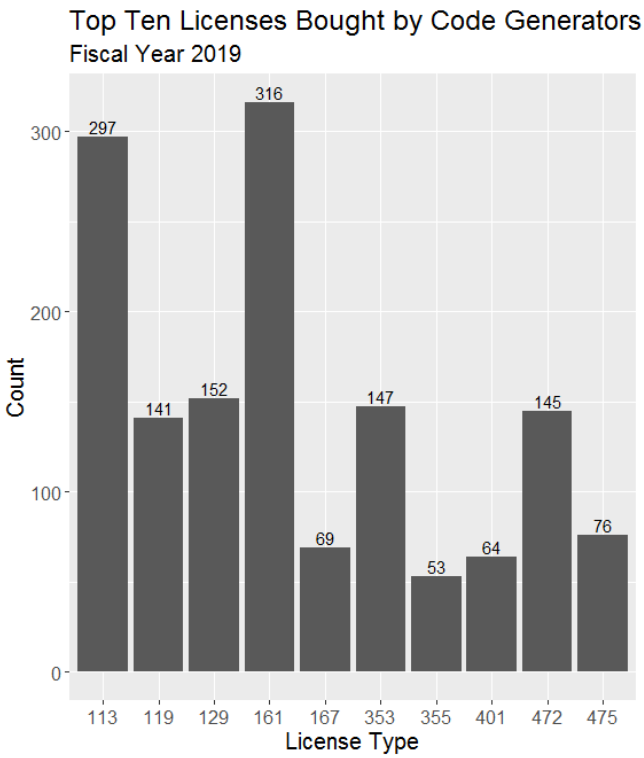
Group	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Generated	18	31	41	41.5	50	79
Redeemed	18	25	32	34.6	41	72

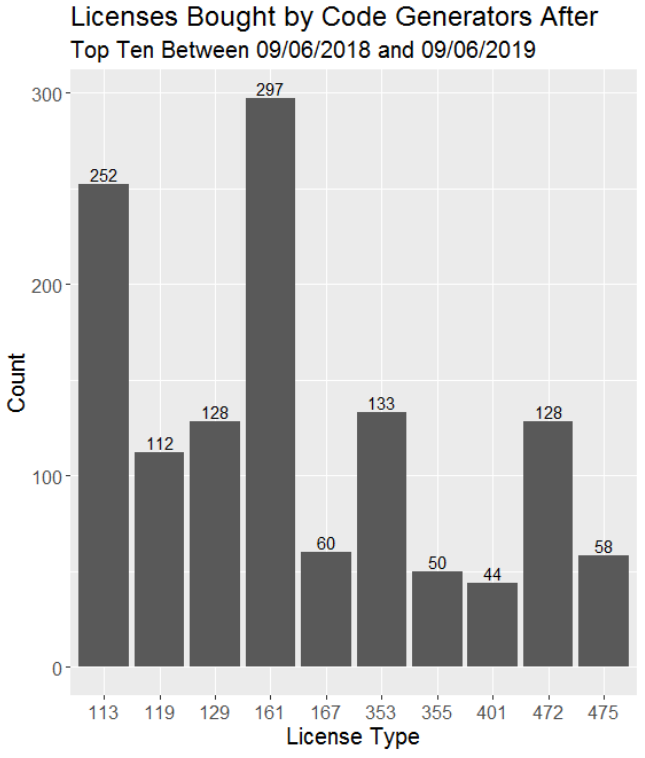
Licenses Purchased

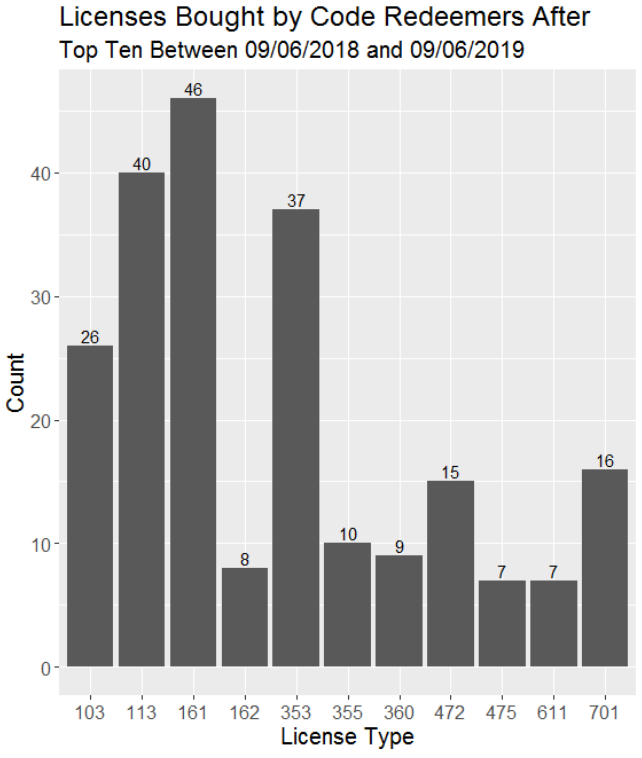




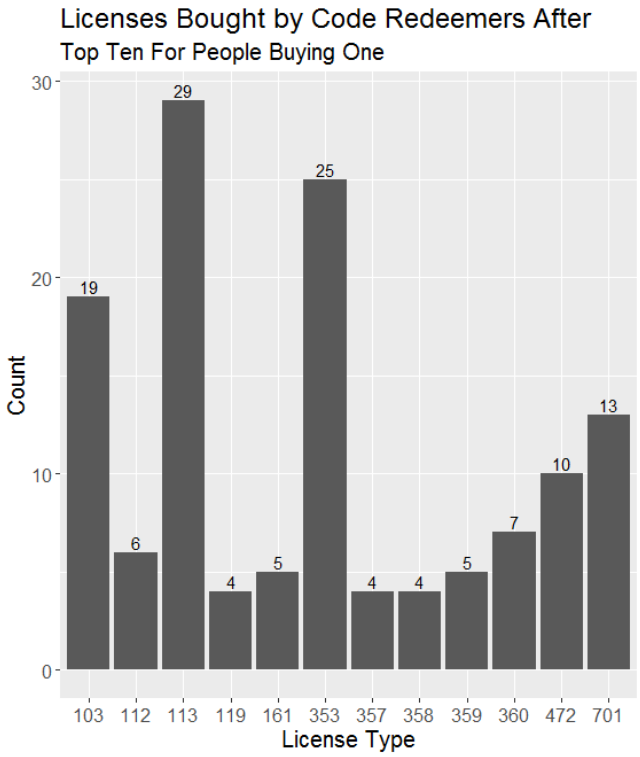

Top Ten Licenses Bought by Code Generators
Fiscal Year 2018
Count
License Type
113 119 129 161 167 353 355 401 472 475
276 142 154 281 56 139 40 58 123 69
0 100 200 300


Top Ten Licenses Bought by Code Generators
Fiscal Year 2019
Count
License Type
113 119 129 161 167 353 355 401 472 475
297 141 152 316 69 147 53 64 145 76
0 100 200 300


Licenses Bought by Code Generators After
Top Ten Between 09/06/2018 and 09/06/2019
Count
License Type
113 119 129 161 167 353 355 401 472 475
252 112 128 297 60 133 50 44 128 58
0 100 200 300

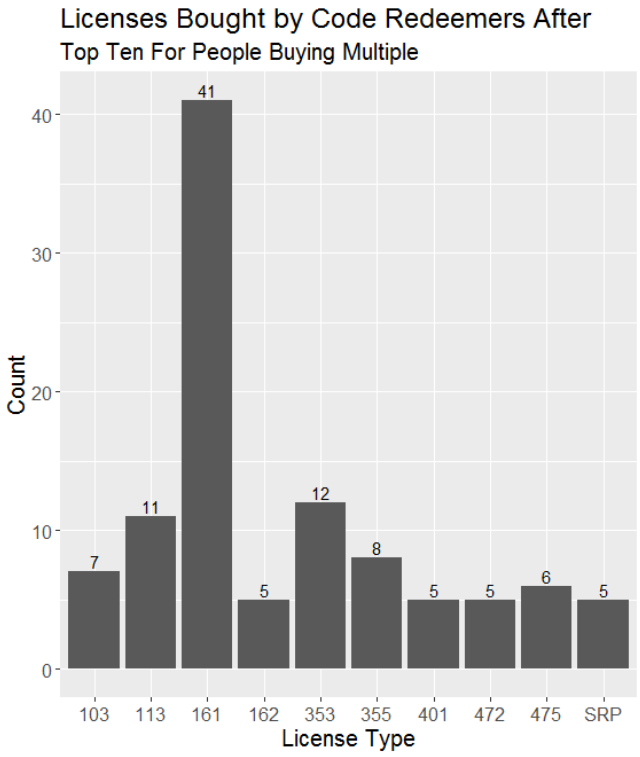

Licenses Bought by Code Redeemers After
Top Ten Between 09/06/2018 and 09/06/2019
Count
License Type
103 113 161 162 353 355 360 472 475 611 701
26 40 46 8 37 10 9 15 7 7 16
0 10 20 30 40

People Who Only Bought One License



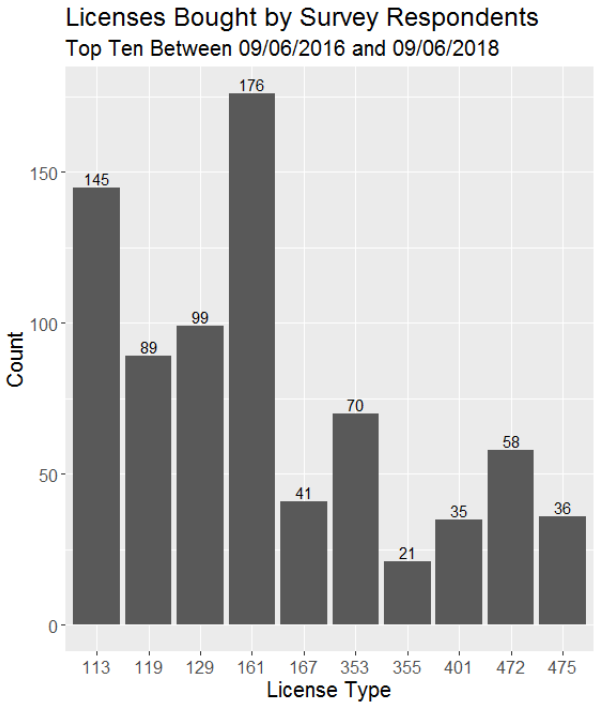
License	Amount	License	Amount
101	1	**103**	13
104	3	**111**	1
112	4	**113**	21
114	3	**120**	1
122	2	**145**	1
161	26	**162**	1
335	1	**353**	29
354	3	**355**	5
357	4	**358**	4
359	4	**360**	8
371	1	**401**	2
461	1	**463**	1
472	2	**475**	1
611	4	**613**	1
701	15	**703**	2
716	1	**CMF**	1
MCP	2	**SR65**	1

People Who Bought Multiple Licenses

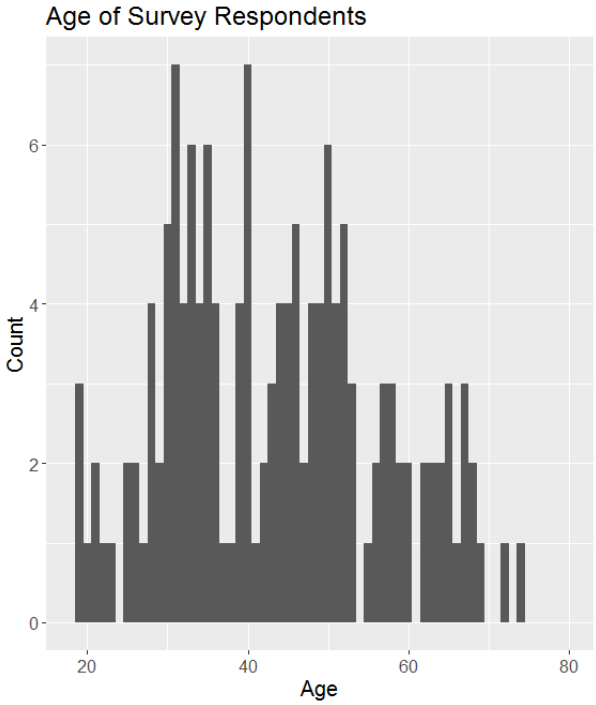


License	Amount	License	Amount
101	2	**103**	13
112	2	**113**	19
114	3	**119**	5
122	1	**129**	6
161	20	**162**	7
167	2	**353**	8
355	5	**356**	2
359	1	**360**	1
401	3	**461**	1
472	13	**475**	6
491	1	**611**	3
701	1	**FCP**	4
FR65	1	**MCP**	4
SRP	5		

Licenses Bought by Survey Respondents



License	Amount	License	Amount
101	20	**103**	1
111	4	**113**	145
114	10	**119**	89
120	4	**122**	9
123	5	**127**	3
129	99	**133**	3
136	1	**137**	2
151	2	**153**	1
155	1	**161**	176
162	13	**167**	41
168	1	**243**	1
245	4	**335**	1
353	70	**354**	1
355	21	**356**	1
357	1	**371**	1
385	1	**401**	35
472	58	**475**	36
491	15	**611**	16
614	1	**615**	9
617	1	**659**	1
701	10	**CCF**	1
CMF	2	**DOF**	10
FCP	1	**FR44**	1
FR64	1	**FR65**	1
FRD	2	**FRV**	1
HR44	1	**HR64**	1
HR65	2	**HRD**	2
HRV	1	**MCP**	1
PRV	1	**SR65**	2
SRD	2	**SRP**	1
TR64	2	**TR65**	1



Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
19	33	43	43.5	52	74

Statistical Testing

The purpose of this statistical test is to determine whether the group that generated codes for the Refer a Friend program purchased certain licenses during fiscal years 2016-2019 at a higher rate than the general population of license buyers in the same time period. This was accomplished by determining the total number of each license type purchased by the code generators and the rest of the license purchasing population, then dividing that number by the total number of licenses purchased by each group to arrive at a percentage for each license type. These percentages were then used to calculate the percent difference between both groups, with the overall percentage serving as the control group. The formula used for this calculation was: $\frac{\%Gen-\%Overall}{\%Overall}$.

Following these calculations, the code generators and the overall population were further divided into two groups of "bought" and "not bought". This resulted in a two by two grid of categorical data on which we ran a Chi-square test. The group percentages, percent differences, and p-values associated with the tests are reported in the table below. We use an $\alpha = 0.05$ significance level, and notice that there are nine license types with positive lift and a significant p-values from the Chi-square test: **101**, **113**, **114**, **119**, **129**, **161**, **167**, **401**, and **475**. This tells us that the code generators accounted for a statistically significant higher percentage of people from those license types than we would expect from random chance alone. Since this program targeted current hunters, it follows that people holding the most common hunting licenses would be present in higher concentrations. Much like the code generators in the fishing program had lower percentages of hunting licenses, we notice that the fishing specific license types, **353**, **355**, and **701**, are present in statistically significant lower amounts among the code generators for the hunting program compared to the overall group.

License	% Generators	% Overall	% Lift	Significance
101	2.05%	1.00%	+104.6%	***<0.001***
103	0.28%	0.23%	+21.6%	0.4838
111	0.34%	0.51%	-32.0%	+0.0820+
113	15.89%	11.61%	+36.8%	***<0.001***
114	1.20%	0.88%	+34.6%	*0.0109*
119	8.30%	4.87%	+70.6%	***<0.001***
129	8.91%	6.57%	+35.6%	***<0.001***
161	16.90%	13.43%	+25.8%	***<0.001***
167	3.57%	2.62%	+35.9%	***<0.001***
353	8.37%	16.95%	-50.6%	***<0.001***
355	2.53%	4.08%	-38.3%	***<0.001***
401	3.08%	1.55%	+98.3%	***<0.001***
472	7.58%	7.25%	+4.7%	0.3103
475	3.83%	2.02%	+89.6%	***<0.001***
701	2.06%	3.33%	-38.1%	***<0.001***

***Statistically significant at <0.001 level
*Statistically significant at 0.01-0.05 level
+Statistically significant at 0.05-0.1 level

Next, we are interested in the difference in the mean number of years the code generators purchased each license type compared to the general license purchasing population during the same four year period as above (2016-2019). We begin by taking five samples from the general population group for 615 unique Customer ID numbers each, then find the number of years each Customer ID number purchased a specific license for all groups during the stated time period. The mean number of years is then found for each license type with the mean of the five means taken for the sample groups, the difference between code generators and general population is taken, and a two sample t-test is performed to determine if the difference in means is statistically significant at the $\alpha = 0.05$ level. There are no license types with a positive difference and significant p-value at the chosen level.

Generators: Number of Years Purchased out of Four						
License	**Total**	**1 Year**	**2 Years**	**3 Years**	**4 Years**	**Mean**
101	130	27	11	11	12	2.13
103	15	15	0	0	0	1.00
111	22	9	3	1	1	1.57
113	1000	76	61	86	136	2.79
114	76	12	8	4	9	2.30
119	519	55	45	42	62	2.54
129	564	45	40	41	79	2.75
161	1069	77	69	70	161	2.84
167	228	41	22	21	20	2.19
353	526	109	80	47	29	1.98
355	161	53	23	18	2	1.68
401	189	38	24	17	13	2.05
472	466	63	39	31	58	2.44
475	240	43	21	17	26	2.24
701	131	44	10	17	4	1.75

Mean Number of Years Purchased out of Four				
License	**Mean Generators**	**Mean Overall**	**Difference**	**P-Value**
101	2.131	2.250	-0.119	0.5987
103	1.000	1.042	-0.042	0.3332
111	1.571	1.747	-0.176	0.5838
113	2.786	2.920	-0.135	+0.0835+
114	2.303	2.577	-0.274	0.3183
119	2.544	2.446	+0.098	0.3808
129	2.751	2.673	+0.078	0.4767
161	2.836	2.960	-0.124	0.1140
167	2.192	2.185	-0.007	0.9603
353	1.984	2.024	-0.039	0.6500
355	1.677	1.815	-0.138	0.2939
401	2.054	2.149	-0.095	0.5745
472	2.440	2.644	-0.205	0.1023
475	2.243	2.416	-0.173	0.3117
701	1.747	1.623	+0.124	0.4598

+Statistically significant at 0.05-0.1 level

License Types

Purchased by Redeemers

101	Sportsmans Hunting and Fishing
103	Resident Apprentice Hunting
104	Non-Resident Apprentice Hunting
111	County/City Resident Hunting
112	Non-Resident 3-Day Hunting
113	Resident State Hunting
114	Non-Resident State Hunting
119	Resident Archery
120	Non-Resident Archery
122	Non-Resident Muzzleloader
129	Resident Muzzleloader
145	Resident Special Fox Hunting
161	Resident Deer Turkey
162	Non-Resident Deer Turkey
167	Resident Bear
335	Resident 65+ Freshwater Fishing
353	Resident State Fishing
354	Non-Resident State Freshwater Fishing
355	Resident Trout Fishing
356	Non-Resident Trout Fishing
357	County/City Resident Freshwater Fishing
358	Non-Resident 5-Day Freshwater Fishing
359	Resident 5-Day Freshwater Fishing
360	Non-Resident 1-Day Freshwater Fishing
371	Resident State Freshwater Fishing - 2 Year
461	Access Permit - Daily
401	Federal Duck Stamp (E-Stamp)
463	Access Permit - Annual
472	National Forest Permit
475	Migratory Waterfowl Conservation Stamp
480	Public Access Lands for Sportsmen (PALS)
491	Virginia State Forest Use Permit
611	Resident Individual Saltwater Fishing
612	Non-Resident Individual Saltwater Fishing
613	Resident 10-Day Saltwater Fishing
614	Non-Resident 10-Day Saltwater Fishing
615	Resident Saltwater Boat Sport Fishing
651	Saltwater Recreational Use Fishing Cast Net
701	Resident State Fresh/Saltwater Fishing
702	Non-Resident State Fresh/Saltwater Fishing
703	Resident 5-Day Fresh/Saltwater Fishing
704	Non-Resident 5-Day Fresh/Saltwater Fishing
CMF	Clinch Mountain 1-Day Fee Fishing
FCP	Special Regulation Trout - Buffalo Creek
FR60	Freshwater Fishing Resident 56-60
FR64	Freshwater Fishing Resident 61-64
FR65	Freshwater Fishing Resident 65+
HR60	Hunting Resident 56-60
MCP	Special Regulation Trout - Mossy Creek
SR60	Saltwater Fishing Resident 56-60
SR65	Saltwater Fishing Resident 65+
SRP	Special Regulation Trout - South River

Used in Statistical Testing

101	Sportsmans Hunting and Fishing
103	Resident Apprentice Hunting
111	County/City Resident Hunting
113	Resident State Hunting
114	Non-Resident State Hunting
119	Resident Archery
129	Resident Muzzleloader
161	Resident Deer Turkey
167	Resident Bear
353	Resident State Freshwater Fishing
354	Non-Resident State Freshwater Fishing
355	Resident Trout Fishing
357	County/City Resident Freshwater Fishing
401	Federal Duck Stamp
472	National Forest Permit
475	Migratory Waterfowl Conservation Stamp
701	Resident State Fresh/Saltwater Fishing