
RANDOM SAMPLING - SHOW ME THE MONEY!

INTRODUCTION

1. Name your favorite movie of all time.
2. On average, how much money do you think a movie grosses (earns) in theaters?
3. Take a guess at the title of the top-grossing movie of 2013.
4. What do you think was the maximum amount grossed by a movie in 2013?

SAMPLING METHODS

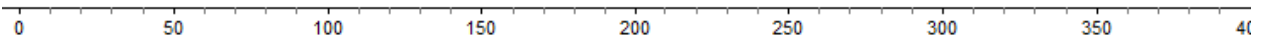
5. Take a look at the list of the 200 top-grossing movies of 2013 and select 10 that you saw (or wanted to see) in theaters. For purposes of this activity, we will consider these 200 movies as a small population. In practice, populations are often much larger than 200 individuals, sometimes reaching the hundreds of millions or more. Write the titles of those movies in the table below, along with the amount they grossed in 2013. Notice that the listing of movies gives the gross income rounded to the nearest tenth of a million, so that a movie listed as earning \$191.5 really grossed \$191,500,000. The order in which you write the movies in the table below does not matter.

Movie Title	Gross Income (Millions)

6. Compute and record the mean gross income for the 10 movies you selected. This number is called the sample mean.
7. Is your sample mean the same as all the other sample means computed by the other students in your class?

It's probably not surprising to you that your sample mean differs from those of other students because you have most likely chosen different samples. The fact that different samples yield different statistics (in this case different sample means) is called sampling variability.

8. Combine your results with those of your classmates by creating a dotplot of sample means on the board. Then, record this dotplot on the number line below, carefully labeling the axis.



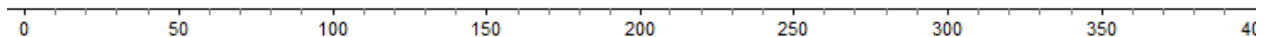
9. Based on the previous dotplot, without any calculations, what do you suppose the mean gross income for the population of all 200 movies might be?

The method you used to take samples from the population is based on your experience and interest in movies. It turns out that this is not a particularly good way to sample if you wish to generate samples that are representative (good images) of the population. Instead of using human experience, judgment, or interest to choose samples, statisticians use chance to select samples from large populations. Samples selected by a chance process are called random samples.

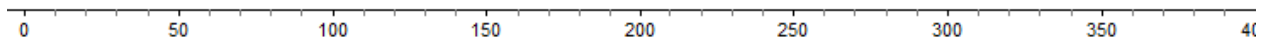
10. Your instructor will give you instructions on how to use random chance to select 10 movies from the population of 200 movies. You will draw chips from a container, use a table of random digits, or use technology to generate 10 random numbers from 1-200. Find the ID numbers in the table below that match your randomly chosen numbers. Record the ID number, title of the movie, and gross income in the following table.

ID Number	Movie Title	Gross Income (Millions)

11. Compute and record the mean gross income for the 10 movies you selected. This number is called the sample mean, but this time the sample mean has been generated by a random sample. Is your sample mean the same as all the other sample means computed by the other students in your class?
12. Combine your results with those of your classmates by creating a dotplot of sample means on the board. Then, record this dotplot on the number line below, carefully labeling the axis.



13. Based on the previous dotplot, without any calculations, what do you suppose the mean gross income for the population of all 200 movies might be?
14. Is your guess for the mean gross income from a random sample somewhat different from your guess when you chose your own sample?
15. The population's mean gross income for the population of all 200 movies is \$54.4 million. Go back to your dotplots in #8 and #12 and draw a vertical line on your number line at 54.4. Did the sample means from you and your classmates do a pretty good job of estimating the population mean when you chose your sample by thinking of movies you saw or wished to see? How about when you obtained your samples through chance? What have you learned about the use of random samples from populations?
16. With enough time, you and your classmates could continue drawing *random samples* of 10 movies, computing the sample mean for each sample, and building the dotplot in #12 above. In order to save time, your instructor will show you a simulation of this process using Fathom software. When the simulation is finished, create a rough sketch of the resulting dotplot below. Label the horizontal axis and draw two vertical lines: one at the center of all the dots and one at the population mean.



It should be clear that rather than producing haphazard results, random sampling actually follows regular patterns that can be predicted with advanced mathematics and statistics. These patterns can then be used to make inferences (conclusions) about the population from random samples.

ID	Movie Title	Total Gross (Millions)
001	The Hunger Games: Catching Fire	424.7
002	Iron Man 3	409.0
003	Frozen	400.7
004	Despicable Me 2	368.1
005	Man of Steel	291.0
006	Gravity	274.1
007	Monsters University	268.5
008	The Hobbit: The Desolation of Smaug	258.4
009	Fast & Furious 6	238.7
010	Oz The Great and Powerful	234.9
011	Star Trek Into Darkness	228.8
012	Thor: The Dark World	206.4
013	World War Z	202.4
014	The Croods	187.2
015	The Heat	159.6
016	We're the Millers	150.4
017	American Hustle	150.1
018	The Great Gatsby (2013)	144.8
019	The Conjuring	137.4
020	Identity Thief	134.5
021	Grown Ups 2	133.7
022	The Wolverine	132.6
023	Anchorman 2: The Legend Continues	125.2
024	Lone Survivor	125.1
025	G.I. Joe: Retaliation	122.5
026	Cloudy with a Chance of Meatballs 2	119.8
027	Now You See Me	117.7
028	The Wolf of Wall Street	116.9
029	Lee Daniels' The Butler	116.6
030	The Hangover Part III	112.2
031	Epic	107.5
032	Captain Phillips	107.1
033	Jackass Presents: Bad Grandpa	102.0
034	Pacific Rim	101.8
035	This is the End	101.5
036	Olympus Has Fallen	98.9
037	42	95.0
038	Elysium	93.1
039	Planes	90.3
040	The Lone Ranger	89.3
041	Oblivion	89.1
042	Insidious Chapter 2	83.6
043	Saving Mr. Banks	83.3
044	Turbo	83.0
045	2 Guns	75.6
046	White House Down	73.1
047	Mama	71.6
048	Safe Haven	71.3
049	The Smurfs 2	71.0
050	The Best Man Holiday	70.5

ID	Movie Title	Total Gross (Millions)
051	Percy Jackson: Sea of Monsters	68.6
052	A Good Day to Die Hard	67.3
053	Warm Bodies	66.4
054	Jack the Giant Slayer	65.2
055	The Purge	64.5
056	Last Vegas	63.9
057	Ender's Game	61.7
058	Prisoners	61.0
059	After Earth	60.5
060	The Secret Life of Walter Mitty	58.2
061	Escape From Planet Earth	57.0
062	12 Years a Slave	56.7
063	Free Birds	55.8
064	Hansel and Gretel: Witch Hunters	55.7
065	Evil Dead (2013)	54.2
066	Red 2	53.3
067	Tyler Perry's A Madea Christmas	52.5
068	Tyler Perry's Temptation: Confessions of a Marriage Counselor	52.0
069	The Call	51.9
070	Pain and Gain	49.9
071	Gangster Squad	46.0
072	Jurassic Park 3D	45.4
073	The Internship	44.7
074	Instructions Not Included	44.5
075	Snitch	42.9
076	Riddick	42.0
077	A Haunted House	40.0
078	47 Ronin	38.4
079	August: Osage County	37.7
080	Philomena	37.7
081	The Family (2013)	36.9
082	Walking with Dinosaurs	36.1
083	Carrie (2013)	35.3
084	Texas Chainsaw 3D	34.3
085	R.I.P.D.	33.6
086	Blue Jasmine	33.4
087	Kevin Hart: Let Me Explain	32.2
088	Side Effects (2013)	32.2
089	Scary Movie 5	32.0
090	The Mortal Instruments: City of Bones	31.2
091	Delivery Man	30.7
092	Grudge Match	29.8
093	One Direction: This is Us	28.9
094	Kick-Ass 2	28.8
095	Dallas Buyers Club	27.3
096	Rush (2013)	26.9
097	The Host (2013)	26.6
098	The World's End	26.0
099	21 and Over	25.7
100	Her (2013)	25.6

ID	Movie Title	Total Gross (Millions)
101	Escape Plan	25.1
102	Don Jon	24.5
103	The Incredible Burt Wonderstone	22.5
104	The Big Wedding	21.8
105	Mud	21.6
106	Baggage Claim	21.6
107	The Way, Way Back	21.5
108	The Book Thief	21.5
109	The Place Beyond the Pines	21.4
110	Homefront	20.2
111	Broken City	19.7
112	Beautiful Creatures (2013)	19.5
113	Runner Runner	19.3
114	You're Next	18.5
115	Quartet	18.4
116	Admission	18.0
117	Nebraska	17.7
118	Parker	17.6
119	Enough Said	17.6
120	Dark Skies	17.4
121	The Counselor	17.0
122	Jobs	16.1
123	Fruitvale Station	16.1
124	About Time	15.3
125	The Last Exorcism Part II	15.2
126	Spring Breakers	14.1
127	Inside Llewyn Davis	13.2
128	The Last Stand	12.1
129	Out of the Furnace	11.3
130	Dead Man Down	10.9
131	Getaway (2013)	10.5
132	Bullet to the Head	9.5
133	Tyler Perry Presents Peeples	9.2
134	Battle of the Year	8.9
135	Movie 43	8.8
136	Mandela: Long Walk to Freedom	8.3
137	Before Midnight	8.1
138	Dhoom 3	8.0
139	Machete Kills	8.0
140	Paranoia	7.4
141	Black Nativity	7.0
142	The Spectacular Now	6.9
143	The Grandmaster	6.6
144	All Is Lost	6.3
145	Believe	6.2
146	The Bling Ring	5.8
147	Pulling Strings	5.8
148	Closed Circuit	5.8
149	The Wizard of Oz (3D/IMAX)	5.6
150	Chennai Express	5.3

ID	Movie Title	Total Gross (Millions)
151	The Company You Keep	5.1
152	20 Feet from Stardom	4.9
153	Jerusalem	4.6
154	Much Ado About Nothing (2013)	4.3
155	Frances Ha	4.1
156	Yeh Jawaani Hai Deewani	3.8
157	The To-Do List	3.5
158	Metallica Through the Never	3.4
159	Emperor	3.3
160	Journey to the South Pacific	3.3
161	Stand Up Guys	3.3
162	The Fifth Estate	3.3
163	Top Gun 3D	3.0
164	In a World	3.0
165	Home Run	2.9
166	The Great Beauty	2.9
167	Filly Brown	2.9
168	Ram-Leela	2.7
169	Grace Unplugged	2.5
170	The Sapphires	2.5
171	The Gatekeepers	2.4
172	I'm In Love With a Church Girl	2.4
173	No (2013)	2.3
174	Trance	2.3
175	The East	2.3
176	Renoir	2.3
177	The Christmas Candle	2.3
178	Blue Is the Warmest Color	2.2
179	Oldboy (2013)	2.2
180	Krrish 3	2.2
181	Austenland	2.2
182	The Saratov Approach	2.1
183	2013 Oscar Nominated Short Films	2.1
184	Blackfish	2.1
185	The Iceman (2013)	2.0
186	Fill the Void	1.8
187	Girl Rising	1.7
188	The Attack	1.7
189	Stoker	1.7
190	Unfinished Song	1.7
191	Bhaag Milkha Bhaag	1.6
192	Love is All You Need	1.6
193	Stories We Tell	1.6
194	Race 2	1.6
195	Bless Me Ultima	1.6
196	Kon-Tiki	1.5
197	Disconnect	1.4
198	Girl Most Likely	1.4
199	I'm So Excited	1.4
200	Wadjda (U.S. only)	1.3