Probability Rules (Basics)

Real life situations involving probability:
- How will the probability of rain affect your camping plans? (Jacket today? Outdoor wedding plans, etc?)
- How does the probability of a person earning a given degree relate to future income? (See Tables below.*)
- Will I use a seat belt? (67% reduction in mortality in car accidents with seat belt use**)
- What route will I take to work today?
- The price of your car insurance. (https://www.esurance.com/info/car/why-women-pay-less-for-car-insurance)
- Should I purchase life insurance? Hazard insurance before my flight? Cashback insurance (Aflac)?

The probability that an event A will occur is represented as P(A). This probability is expressed as a number between 0 and 1 indicating the likelihood that event A will occur.
P(A) = 0 - the event A will almost definitely not occur.
P(A) = close to zero - there is a very small chance A will occur.
P(A) = .5 - there is a 50 - 50 chance event A will occur.
P(A) = close to one - there is a strong chance event A will occur.
P(A) = 1 - Event A will almost definitely occur.

Describe the likelihood of event A in each problem.

1) A - Rain today.
P(A) = .2

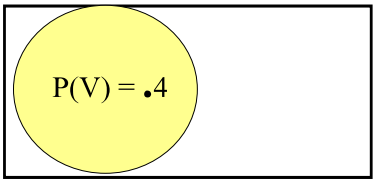
2) F - Linda makes a free throw.
P(F) = 7/10

3) T - I pass the next test!
P(T) = .89

4) G - Mike hits the field goal.
P(G) = 50%

5) B - Spinning a Blue.
P(B) =

6) V - Random event.



Sum of Probabilities Rule - The sum of probabilities for all possible outcomes of an experiment is equal to one (1). If an experiment has three possible outcomes (A, B, and C), then P(A) + P(B) + P(C) = 1.

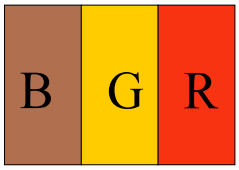
Give the probability of each element of the sample space. What is the sum of these elements?

7) Flipping a fair coin.

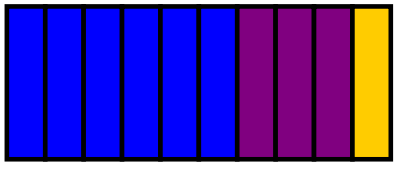
8) Rolling a fair 5 sided die
The faces are lettered A, B, C, D, E.

9) John hitting a baseball.
He bats .230.

10) A fly landing on the flag.

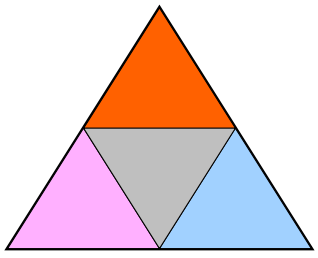


11)



P(B) =
P(P) =
P(Y) =

12)



Complement Rule - The complement of an event is the event not occurring. The probability that Event A will not occur is denoted P(A') or $P(A^c)$.

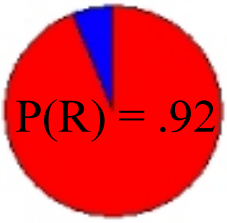
Subtraction Rule - The probability that event A will occur is equal to 1 minus the probability that event A will NOT occur. **P(A) = 1 - P(A')**

Give the probability of the complement of each event.

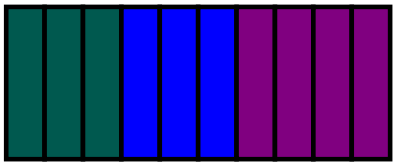
13) A - Rolling a 5 on a 6-sided die.
$P(A^c)$ =

14) B - Tim making a basket. His shooting percentage is .73.
$P(B^c)$ =

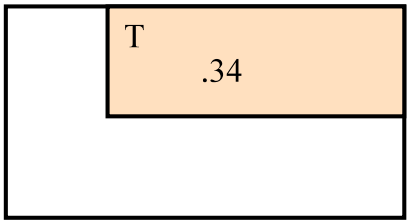
15) P(R')



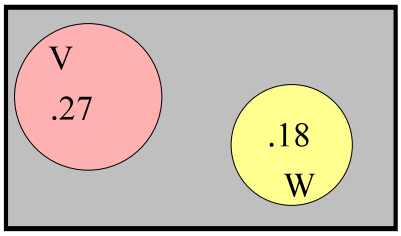
16) P(G') =



17) $P(T^c)$



18) $P(V^c)$



19) In 2012, 189,000,000 tickets in the Powerball lottery were sold. What is the probability that a person who purchased 1 ticket for $2 will win the Jackpot P(J)?

20) Give $P(J^c)$ for number 19. (The probability that the person who purchased a ticket will NOT win the lottery.)

21) What is the probability that a person who purchased 50 ticket for $100 will win the Jackpot P(J)?

22) Give $P(J^c)$ for number 21. (The probability they will NOT win the lottery.)

23) John REALLY wants to win the lottery. He purchases 500,000 lottery tickets for $1,000,000. What is the probability P(J) he will win the lottery?

24) Give $P(J^c)$ for number 23. (The probability that John will NOT win the lottery.)

Educational attainment in the United States (2014)*

Education	Age 25 and Over
High school graduate	88.31%
Some college	58.57%
Associate's and/or Bachelor's degree	41.89%
Bachelor's degree	31.96%
Master’s degree	8.5%
Professional Degree	1.5%
Doctorate	1.77%
*Note that these add up to more than 100% because they are cumulative; e.g. it is assumed that all people with doctorates also have undergraduate and high school degrees, and are thus counted twice in the "lower" categories. Age 25 is used rather than age 18 because there are few people aged 18 or over with advanced degrees. "Educational Attainment in the United States: 2014". U.S. Census Bureau. Retrieved January 29, 2015. Percentages are calculated based on Census data by counting people that had attained that level or higher. (Wikipedia - Educational Attainment in the U.S.)	

Householders whose householder is aged twenty-five or older

Year	Overall Median	Less than 9th grade	High school drop-out	High school graduate	Some college	Associates degree	Bachelor's degree	Bachelor's degree or more	Master's degree	Professional degree	Doctorate degree
1991	$40,873	**$17,414**	$23,096	$37,520	$46,296	$52,289	$64,150	**$68,845**	**$72,669**	$102,667	**$92,614**
1993	**$40,324**	$17,450	$22,523	**$35,979**	**$44,153**	**$49,622**	$64,537	$70,349	$75,645	$109,900	$93,712
1995	$42,235	$18,031	**$21,933**	$37,609	$44,537	$50,485	**$63,357**	$69,584	$77,865	**$98,302**	$95,899
1997	$43,648	$17,762	$22,688	$38,607	$45,734	$51,726	$67,487	$72,338	$77,850	$105,409	$99,699
1999	**$46,236**	**$19,008**	$23,977	**$39,322**	**$48,588**	**$54,282**	**$70,925**	**$76,958**	**$82,097**	**$110,383**	**$107,217**
2001	$45,300	$18,830	**$24,162**	$37,468	$47,605	$53,166	$69,796	$75,116	$81,993	$103,918	$96,442
2003	$45,016	$18,787	$22,718	$36,835	$45,854	$51,970	$68,728	$73,446	$78,541	$100,000	$96,830
Average	*$43,376*	*$18,183*	*$23,013*	*$37,620*	*$46,109*	*$51,934*	*$66,997*	*$72,376*	*$78,094*	*$104,368*	*$94,487*

"Educational attainment and median household income". Archived from the original on 2006-09-03. Retrieved 2006-09-24. (Wikipedia - Educational Attainment in the U.S.)

** http://www.ncbi.nlm.nih.gov/pubmed/21720604
http://aje.oxfordjournals.org/content/153/3/219.full