

Core Content

Cluster Title: Understand independence and conditional probability and use them to interpret data.
Standard S.CP.1: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).
Concepts and Skills to Master
<ul style="list-style-type: none"> • Use correct set notation, with appropriate symbols and words, to identify sets and subsets within a sample space. • Identify an event as a subset of a set of outcomes (a sample space). • Draw Venn diagrams that show relationships (unions, intersections, or complements) between sets within a sample space.

Supports for Teachers

Critical Background Knowledge																	
<ul style="list-style-type: none"> • Represent sample spaces. (7.SP.8) 																	
Academic Vocabulary																	
sample space, subset, outcome, union, intersection, complement, \cup , \cap ; A^c , A' , $-A$, \bar{A} (Note: Various notations are commonly used for complement.)																	
Suggested Instructional Strategies	Resources																
<ul style="list-style-type: none"> • Create and use Venn diagrams to illustrate relationships between sample spaces and events. • Perform chance experiments, such as rolling dice or tossing coins, to generate sample spaces and identify events within the sample spaces. 	<ul style="list-style-type: none"> • http://www.shodor.org • Interactivate Venn Diagram Shape Sorter 																
Sample Formative Assessment Tasks																	
<p>Skill-Based Task Describe the event that the summing two rolled dice is larger than 7 <u>and</u> even, and contrast it with the event that the sum is larger than 7 <u>or</u> even.</p>	<p>Problem Task Create a Venn diagram to display the information in the table. Describe the set of students who have a curfew but don't do chores as a subset of the group.</p> <table border="1"> <thead> <tr> <th></th> <th>Curfew: Yes</th> <th>Curfew: No</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Chores: Yes</td> <td>13</td> <td>5</td> <td>18</td> </tr> <tr> <td>Chores: No</td> <td>12</td> <td>3</td> <td>15</td> </tr> <tr> <td>Total</td> <td>25</td> <td>8</td> <td></td> </tr> </tbody> </table>		Curfew: Yes	Curfew: No	Total	Chores: Yes	13	5	18	Chores: No	12	3	15	Total	25	8	
	Curfew: Yes	Curfew: No	Total														
Chores: Yes	13	5	18														
Chores: No	12	3	15														
Total	25	8															

Core Content

Cluster Title: Understand independence and conditional probability and use them to interpret data.
Standard S.CP.2: Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
Concepts and Skills to Master
<ul style="list-style-type: none"> Use appropriate probability notation for individual events as well as their intersection (joint probability). Calculate probabilities for events, including joint probabilities, using various methods (e.g. Venn diagram, frequency table). Compare the product of probabilities for individual events ($P(A) \cdot P(B)$) with their joint probability ($P(A \cap B)$). Understand that independent events satisfy the relationship $P(A) \cdot P(B) = P(A \cap B)$.

Supports for Teachers

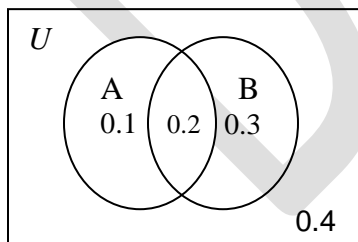
Critical Background Knowledge	
<ul style="list-style-type: none"> Understand basic properties of probability. (7.SP.5) Approximate probabilities of chance events through experiment. (7.SP.6) Use Venn diagrams (II.4.S.CP.1) and two-way frequency tables. (I.S.ID.5) $P(A \cap B)$ is the equivalent of the probability of event A and event B occurring together. (II.4.S.CP.1) 	
Academic Vocabulary	
joint probability, intersection, event, independent events, $P(A)$, $P(A \cap B)$, $P(A \text{ and } B)$	
Suggested Instructional Strategies	Resources
<ul style="list-style-type: none"> Convert frequencies from a Venn diagram or a two-way frequency table into probabilities with correct notation. Generate a two-way frequency table to describe characteristics of your class (e.g., gender and eye color) and use the table to determine if eye color and gender are independent. Compare experimental results to theoretical (long run) probabilities. 	Scheaffer, Richard. "Streaky Behavior" in <i>Activity-Based Statistics, Student Guide, 2nd Edition</i>
Sample Formative Assessment Tasks	
Skill-Based Task	Problem Task
<p>When rolling two dice:</p> <ol style="list-style-type: none"> What is the probability of rolling a sum that is greater than 7? What is the probability of rolling a sum that is odd? What is the probability of rolling a sum that is greater than 7 and is odd? Are the events rolling a sum greater than 7 and rolling a sum that is odd independent? Justify. 	<p>Roll a pair of dice 100 times and keep track of the outcomes. Find pairs of events that are independent and pairs that are not. Justify your conclusions. (For example, the probability of rolling doubles and the probability of rolling 7 vs. the probability of rolling doubles and the probability of rolling a sum that is less than 4.)</p>

Core Content

Cluster Title: Understand independence and conditional probability and use them to interpret data.
Standard S.CP.3: Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B .
Concepts and Skills to Master
<ul style="list-style-type: none"> Understand conditional probability and how it applies to real-life events. Use $P(A B) = \frac{P(A \cap B)}{P(B)}$ to calculate conditional probabilities. Understand that events A and B are independent if and only if they satisfy $P(A B) = P(A)$ or satisfy $P(B A) = P(B)$. Apply the definition of independence to a variety of chance events.

Supports for Teachers

Critical Background Knowledge	
<ul style="list-style-type: none"> Use basic probability notation, particularly $P(A \cap B)$. (II.4.S.CP.2) Understand independent events. (II.4.S.CP.2) 	
Academic Vocabulary	
conditional, independence, conditional probability, $P(A B)$	
Suggested Instructional Strategies	Resources
<ul style="list-style-type: none"> Use Venn diagrams to explore and compute conditional probabilities. 	Cut the Knot – Conditional Probability and Independent Events: http://www.cut-the-knot.org/Curriculum/Probability/ConditionalProbability.shtml Texas A&M – Conditional Probability Applet: http://www.stat.tamu.edu/~west/applets/Venn1.html
Sample Formative Assessment Tasks	
Skill-Based Task Given the following Venn diagram, determine whether events A and B are independent.	Problem Task Is participation in sports independent of participation in the arts?



Core Content

Cluster Title: Understand independence and conditional probability and use them to interpret data.
Standard S.CP.4: Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. (For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.)
Concepts and Skills to Master
<ul style="list-style-type: none"> • Model real-life data using two-way frequency tables. • Recognize that the conditional probability, $P(A B)$, represents the joint probability for A and B divided by the marginal probability of B. • Use $P(A B) = \frac{P(A \cap B)}{P(B)}$ to calculate conditional probabilities from a two-way frequency table. • Apply the definition of independence to a variety of chance events as represented by a two-way frequency table.

Supports for Teachers

Critical Background Knowledge																	
<ul style="list-style-type: none"> • Summarize categorical data in a variety of ways. (I.4.S.ID.5) • Understand what it means for two events to be independent (II.S.CP.2) 																	
Academic Vocabulary																	
conditional, independence, joint probability ($P(A \cap B)$), conditional probability ($P(A B)$), marginal probability																	
Suggested Instructional Strategies	Resources																
<ul style="list-style-type: none"> • Construct two-way tables based on data from news media and investigate independence by computing conditional probabilities. • Analyze two-way tables to determine independence and conditional probability. 	Data and Story Library (DASL): http://lib.stat.cmu.edu/cgi-bin/dasl.cgi?query=Contingency+table&submit=Search!&metaname=methods&sort=swishrank																
Sample Formative Assessment Tasks																	
<p>Skill-Based Task</p> <ol style="list-style-type: none"> 1. Find the probability that a randomly selected student attends summer school. 2. Find the probability that a student is a boy given that they attend summer school. 3. Find the probability that a randomly selected student is a boy who attends summer school. 4. Are the events “Attending Summer School” and “Boys” independent? Justify your answer. <table border="1" data-bbox="96 1189 882 1441"> <tr> <td>Gender</td> <td>Summer School</td> <td>Summer Job</td> <td>Total</td> </tr> <tr> <td>Girls</td> <td>25</td> <td>20</td> <td></td> </tr> <tr> <td>Boys</td> <td>35</td> <td>20</td> <td></td> </tr> <tr> <td>Total</td> <td></td> <td></td> <td></td> </tr> </table>	Gender	Summer School	Summer Job	Total	Girls	25	20		Boys	35	20		Total				<p>Problem Task</p> <p>Select two categorical variables and conduct research to answer various probability questions and determine independence. Write a “newsworthy” article for the school newspaper that interprets the interesting relationships between the events.</p>
Gender	Summer School	Summer Job	Total														
Girls	25	20															
Boys	35	20															
Total																	

Core Content

Cluster Title: Understand independence and conditional probability and use them to interpret data.
Standard S.CP.5: Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. (For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.)
Concepts and Skills to Master
<ul style="list-style-type: none"> Interpret conditional probabilities and independence in context.

Supports for Teachers

Critical Background Knowledge													
<ul style="list-style-type: none"> Summarize categorical data in a variety of ways. (I.4.S.ID.5) Find probabilities of events using tree diagrams. (7.SP.8) Understand independence. (II.4.S.CP.2) Understand and calculate conditional probabilities. (II.4.S.CP.3) 													
Academic Vocabulary													
conditional probability, independence.													
Suggested Instructional Strategies	Resources												
<ul style="list-style-type: none"> Practice representing conditional probabilities using tree diagrams. Find the probability that a randomly selected athlete is an honors student. Have students generate questions similar to the example in the standard and pursue the answers. 	Stat Trek: http://stattrek.com/ap-statistics-1/association.aspx												
Sample Formative Assessment Tasks													
Skill-Based Task: Is owning a smart phone independent from grade level? <table border="1" data-bbox="184 1206 1010 1396"> <thead> <tr> <th></th> <th>Own smart phone</th> <th>Do not own smart phone</th> </tr> </thead> <tbody> <tr> <td>10th Grade</td> <td>204</td> <td>170</td> </tr> <tr> <td>11th Grade</td> <td>192</td> <td>160</td> </tr> <tr> <td>12th Grade</td> <td>198</td> <td>165</td> </tr> </tbody> </table>		Own smart phone	Do not own smart phone	10 th Grade	204	170	11 th Grade	192	160	12 th Grade	198	165	Problem Task: Have students find and interpret probability statements in media.
	Own smart phone	Do not own smart phone											
10 th Grade	204	170											
11 th Grade	192	160											
12 th Grade	198	165											