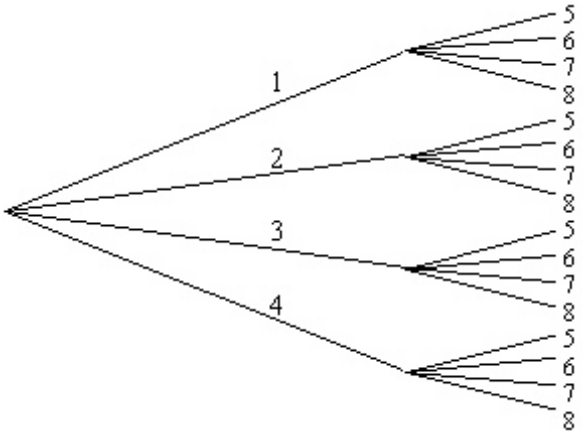
1) A section of an exam contains two multiple-choice questions, each with three answer choices (listed "A", "B", and "C"). List all the outcomes of the sample space. 1) D

A) {A, B, C}
B) {AA, AB, AC, BB, BC, CC}
C) {AB, AC, BA, BC, CA, CB}
D) {AA, AB, AC, BA, BB, BC, CA, CB, CC}

Three choices for the first questions and three choices for the second: 3 x 3 = 9 choices

2) Box A contains the numbers 1, 2, 3, and 4. Box B contains the numbers 5, 6, 7, and 8. A number is first drawn from Box A and then another number from Box B. Using the figure below, how many outcomes are possible if both numbers are even? 2) A



Both even? (2,6), (2,8), (4,6) & (4,8)

A) 4 B) 16 C) 6 D) 8

3) If two dice are rolled one time, find the probability of getting a sum less than 5. 3) C

A) $\frac{1}{3}$ B) $\frac{5}{36}$ C) $\frac{1}{6}$ D) $\frac{7}{36}$

sum=2 only one: (1,1)
sum=3 two outcomes: (1,2) & (2,1)
sum=4 three outcomes: ((1,3), (3,1) & (2,2)

P(sum < 5)= P(sum=2) + P(sum=3) + P(sum=4) = 1/36 + 2/36 + 3/36 = 6/36 = 1/6

4) According to a survey, 31% of teenagers could recognize a picture of legendary film star John Wayne. What is the probability that a randomly-selected teenager could recognize John Wayne? 4) A

A) 0.31 B) 0.45 C) 0.69 D) 0.01

Selecting one teenager at random, probability is 31%, as a decimal: 0.31

5) A section of an exam contains two multiple-choice questions, each with three answer choices (listed "A", "B", and "C"). Assuming the outcomes to be equally likely, find the probability (as a reduced fraction) that both answers are the same ("AA", "BB" or "CC"). [Hint: List all the outcomes of the sample space first.] 5) B

A) 1/9 B) 1/3 C) 1/27 D) 1/6

This question is based on the sample space generated in question 1: 3 out of 9 = 3/9 = 1/3

6) The staff at a small company includes: 4 secretaries, 20 technicians, 4 engineers, 2 executives, and 50 factory workers. If a person is selected at random, what is the probability that he or she is a factory worker? 6) D

A) $\frac{2}{5}$ B) $\frac{1}{4}$ C) $\frac{1}{8}$ D) $\frac{5}{8}$

Total staff = 4 + 20 + 4 + 2 + 50 = 80 P(factory worker) = 50/80 = 5/8

7) At a certain college, there were 300 science majors, 300 engineering majors, and 400 business majors. If one student was selected at random, the probability that the student is an engineering major is _____. 7) C

A) $\frac{1}{3}$ B) $\frac{7}{10}$ C) $\frac{3}{10}$ D) $\frac{3}{7}$

Total number of students = 300 + 300 + 400 = 1000 P(engineering major) = 300/1000 = 3/10

8) A couple has four children. Find the probability that all of them are girls. 8) D

A) $\frac{1}{2}$ B) $\frac{1}{8}$ C) $\frac{1}{4}$ D) $\frac{1}{16}$

The sample space --that is, the total number of possible outcomes, is 16 since there are 2 choices (Girl/Boy) each time: 2 x 2 x 2 x 2 =16 and only one of those outcomes consists of four girls in a row: GGGG; therefore P(4 girls) = 1/16

9) A couple has four children. Find the probability that there are exactly two boys and two girls. 9) C

A) $\frac{1}{8}$ B) $\frac{1}{16}$ C) $\frac{3}{8}$ D) $\frac{5}{8}$

Two boys and two girls may occur in six distinct permutations: one is BBGG, another is BGBG, or GGBB, etc. How to calculate the total number of permutations for 4 items when there are two pairs of identical items? If all four items (babies or whatever it is) are distinct, the answer would be 4! Now, when some of the items are identical, divide by the repetitions factorial: in this case = 4! / 2! x 2! = 6 Six out of 16 = 6/16 = 3/8

10) A couple has four children. Find the probability that there is at least one girl. 10) D

A) $\frac{11}{16}$ B) $\frac{5}{16}$ C) $\frac{1}{16}$ D) $\frac{15}{16}$

Apply the rule: P at least one ____= 1 - P none of ____ In this case: P at least one _girl___ = 1 - P none of them girls = 1 - P all boys = 1 - 1/16 = 15/16

11) Out of 914 items checked out of a public library, 400 were fiction books, 283 were non-fiction books, and 231 were videos (of any genre). What is the probability that a randomly-selected item was not a video? 11) C

A) 0.338 B) 0.438 C) 0.747 D) 0.253

Two approaches: Since there 914 items, and 231 are videos then 914-231 = 683 Then P(no video) = 683/914 = 0.74726... = 0.747
Another approach: find P(video) = 231/914 = 0.252735 Therefore, P(no video) 1 - P(video) = 1 - 0.252735 = 0.7472 .. = 0.747

12) Human blood is grouped into four types. The percentages of Americans with each type are listed below. 12) A

O: 43% A: 40% B: 12% AB: 5%

Choose one American at random. Find the probability that this person does not have type O blood.

A) 0.57 B) 0.67 C) 0.43 D) 0.47

Since 43% --as a decimal, 0.43 is the probability having type O blood, then P(no O blood) = 1 - P(O blood) = 1 - 0.43 = 0.57

Another approach: since people who have no O blood have either A, or B or AB, add up those probabilities: 0.40 + 0.12 + 0.05 = 0.57

13) On a recent Saturday, a total of 1071 people visited a local library. Of these people, 245 were under age 10, 496 were aged 10–18, 179 were aged 19–30, and the rest were more than 30 years old. 13) D

Organize the data:
Under 10: 245
10-18 : 496
19-30 : 179
Over 30 :
Total : 1071

One person is sampled at random. What is the probability that the person is less than 19 years old?

A) 0.463 B) 0.741 C) 0.229 D) 0.692

P (less than 19) = P(under 10) + P(10-18) = 245/1071 + 496/1071 = 741/1071 = 0.6918.. = 0.692

14) If $P(A) = 0.22$, $P(B) = 0.55$, and A and B are mutually exclusive, find $P(A \text{ or } B)$. 14) B

A) 0 B) 0.77 C) 0.385 D) 0.33

If events are mutually exclusive, then these events cannot occur at the same time, P(A and B) = 0; therefore P(A or B) = P(A) + P(B) = 0.22 + 0.55 = 0.77

15) If one card is drawn from an ordinary deck of cards, what is the probability that the card will be an ace, a king of hearts, or a spade? 15) D

A) $\frac{11}{26}$ B) $\frac{19}{52}$ C) $\frac{9}{26}$ D) $\frac{17}{52}$

P(Ace or King of Hearts or Spade) = P(Ace) + P(King of Hearts) + P(Spade) - P(Ace and Spade) = 4/52 + 1/52 + 13/52 - 1/52 = 17/52

Notice that Ace and Spades are not mutually exclusive: one of the Aces is the Ace of Spades.

16) For a recent year the population for a group of Midwestern states in millions was distributed as follows: 16) _____

Age group	Number
Under 5 years old	4.8
5-17 years	12.1
18-24 years	5.6
25-44 years	19.2
45-64 years	14.5
65+ years	8.5
Total	64.7

If a person is selected at random from a Midwestern state, find the probability that the person is

a. Either 5–17 years old or 25–44 years old.

b. Either 5–24 years old or 45–64 years old.

c. Either under 5 years old or over 64 years old.

a) P (15-17 or 25-44) = 12.1/64.7 + 19.2/64.7 = 0.48377... = 0.484
b) P(5-24 or 45-64) = 17.7/64.7 + 14.5/64.7 = 0.49768... = 0.498
Notice that 5-24 includes 5-17 and 18-24 for a total of 17.7
c) P(under 5 or over 64) = P(under 5 or 65 and plus) = 4.8/64.7 + 8.5/64.7 = 0.2055 = 0.206

17) In a recent study, the following responses were obtained to the question, "Do you favor recycling in your neighborhood?" 17) D

	Yes	***No***	***No Opinion***
Males	25	15	10
Females	30	10	10

Total Males = 50

Total Females = 50 Grand Total: 100

If a response is picked at random, what is the probability that it came from a male or that it indicated no opinion regarding recycling?

A) $\frac{4}{5}$ B) $\frac{7}{10}$ C) $\frac{3}{10}$ D) $\frac{3}{5}$

P(male or No opinion) = P(male) + P(No opinion) - P (Male and No opinion) = 50/100 + 20/100 - 10/100 = 60/100 = 3/5

18) A recent poll found that 30% of those surveyed are worried about aggressive drivers on the road. If three people are selected at random, what is the probability that all three will be worried about aggressive drivers on the road? 18) A

A) 0.027 B) 0.300 C) 0.900 D) 0.081

Anyone selected at random has a prob = 0.30 of being an aggressive driver; therefore, selecting three and all three being aggressive drivers can be represented as follows: P(1st selected is aggressive AND 2nd selected is aggressive AND 3rd selected is aggressive) = 0.30 x 0.30 x 30 = 0.027

19) A lot of 1000 components contains 200 that are defective. Two components are drawn at random and tested. Let *A* be the event that the first component drawn is defective, and let *B* be the event that the second component drawn is defective. 19) B

Find *P*(*A* and *B*).

A) 0.005 B) 0.0398 C) 0.1992 D) 0.2

Two approaches: P(1st defective and 2nd defective) = P(1st defective) x P(2nd is defective given that 1st is defective) = 200/1000 x 199/999 = 0.03983...
Using combinations: P(two defectives) = Choose 2 defectives from 200 defectives components / Choosing 2 components out of 1000: 200C2/1000C2 = 0.03983

20) In a second grade class containing 14 girls and 10 boys, 2 students are selected at random to give out the math papers. What is the probability that both are girls? 20) D

A) $\frac{5}{12} \cdot \frac{9}{23}$ B) $\frac{7}{12} \cdot \frac{7}{12}$ C) $\frac{7}{12} \cdot \frac{14}{23}$ D) $\frac{7}{12} \cdot \frac{13}{23}$

P(1st is a girl and 2nd is a girl) = P(first is a girl) x P(2nd is a girl given that 1st is a girl) = 14/24 x 13/23 = 7/12 x 13/23

21) An unfair coin has a probability 0.4 of landing heads. The coin is tossed four times. What is the probability that it lands heads at least once? 21) A

If P(heads) = 0.4, then P(Tails) = 0.6 => sum of probabilities = 1

A) 0.8704 B) 0.9744 C) 0.25 D) 0.936

P(at least one head = 1 - P no heads = 1 - P(all tails) = 1 - P(four tails in a row) = 1 - 0.6^4 = 0.8704

22) It has been reported that 3% of all cars on the highway are traveling at speeds in excess of 70 mph. If the speeds of four random automobiles are measured via radar, what is the probability that at least one car is going over 70 mph? 22) D

If prob of speeding = 3% = 0.03; then, Prob(no speeding) = 1- 0.03 =.97

A) 0.00000081 B) 0.12 C) 0.89 D) 0.11

P at least one speeding = 1 - P(none of them speeding) = 1 - 0.97^4 = 0.1147... = 0.11

23) Below are listed the numbers of engineers in various fields by sex. Choose one engineer at random. Find *P*(electrical|male). 23) C

	Mechanical	**Electrical**	**Biomedical**
Male	8750	4167	6329
Female	3270	1183	5923

Males Total = 19,246

Grand Total: 29,622

A) 0.779 B) 0.114 C) 0.217 D) 0.141

P(A|B) = P(A and B)/ P(B)

P(electrical|male) = P(electrical and male) / P(male)
= 4167/19246 = 0.2165 ... = 0.217

Note: to be completely formal, we should divide both numerator and denominator by the grand total; anyway, they cancel each other out and that is why I omit dividing by the grand total.

24) A store manager wants to display 5 different brands of toothpaste in a row. How many ways can this be done? 24) A

In how many ways can we arrange N distinct items? N! (n-factorial ways): 5 ! = 120

A) 120 B) 20 C) 24 D) 5

Using permutations: In how may ways can we permute N distinct items taken N at once? nPn = 5P5 = 120

25) There are _____ possible ways that eight pictures can be hung along a wall. 25) D

A) 1 B) 8 C) 5,040 D) 40,320

Same principle as question 24: 8 ! = 40,320 or 8P8 = 40,320

26) There are 2,368 possible ways that a committee of eight people can be selected from a group of 14 people. 26) A

A) False B) True

Selecting (choosing) 8 out of a group of 14. In selecting a committee, nothing indicate that the order of the chose ppl should be considered; therefore, this a combination problem: 14C8 = 3003

27) 7 women and 10 men. Three members are chosen as officers. 27) A

What is the probability that all three officers are women?

A) 0.0515 B) 0.1765 C) 0.01163 D) 0.0698

1st approach: P(1st selected is woman) and P(2nd selected is woman given that the 1st was a woman) and P(3rd selected is woman given that the first two are woman: 7/17 x 6/16 x 5/15 = 0.05147... = 0.0515 OR using combinations: Choosing 3 women from 7 over Choosing 3 people from the group of 17: 7C3/17C3 = 0.0515

28) In a company there are 8 executives: 6 women and 2 men. 2 are selected to attend a management seminar. Find the probability that 1 men and 1 woman will be selected. 28) B

A) ≈ 0.2500 B) 0.4286 C) ≈ 0.0833 D) ≈ 0.0400

P(choosing 1 man AND 1 woman) = choosing 1 man from 2 men and 1 woman from 6 women, in total choosing 2 ppl from a group of 8 = (2C1 x 6C1)/8C2 = 0.42857...

29) A certain system has two components. There are 6 different models of the first component and 10 different models of the second. A salesman must select 2 of the first component and 3 of the second to take on a sales call. How many different sets of components can the salesman take? 29) B

A) 2700 B) 1800

Choosing 2 of the first component of which there are 6 models available: 6C2
Choosing 3 of the second component of which there are 10 models available: 10C3

Choosing the 2 first components AND the 3 second components = 6C2 x 10C3 = 1800