Principles of Math 12 **Name:**_____

Probability Review Assignment

Aug 2003

1.

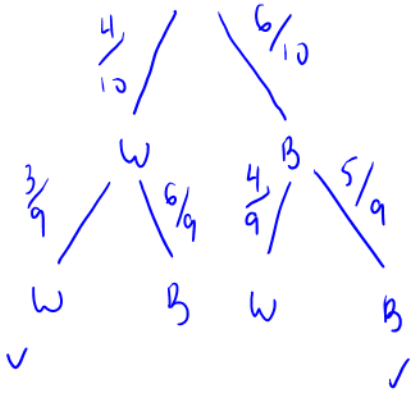
A bag contains 4 white balls and 6 black balls. Two balls are drawn one at a time without replacement. What is the probability that both balls are the same colour?

A. $\frac{2}{15}$

B. $\frac{1}{3}$

C. $\frac{7}{15}$

D. $\frac{8}{15}$



$P(\text{2 the same}) = P(W,W) \text{ or } P(B,B)$

$= \frac{4}{10} \times \frac{3}{9} + \frac{6}{10} \times \frac{5}{9}$

$= \frac{42}{90} = \frac{7}{15}$

2.

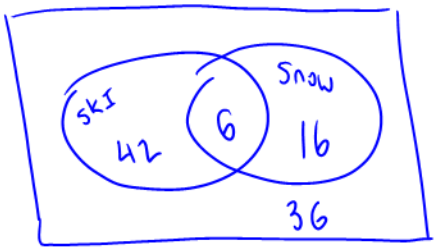
A survey of people that live within 40 km of a ski resort found that 22% go snowboarding, 48% go skiing and 6% do both sports. Determine the probability that a randomly selected person does neither sport.

A. 24%

B. 30%

C. 36%

D. 42%



3.

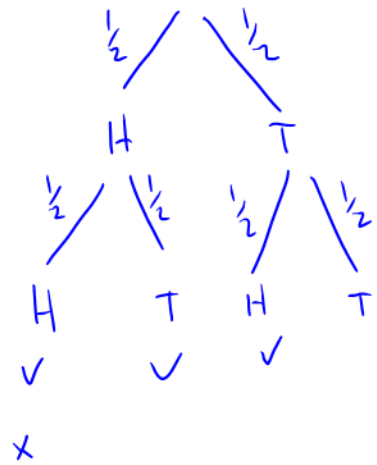
Two fair coins are tossed. What is the probability that both coins are heads, given that at least one of them is a head?

A. $\frac{1}{4}$

B. $\frac{1}{3}$

C. $\frac{1}{2}$

D. $\frac{3}{4}$



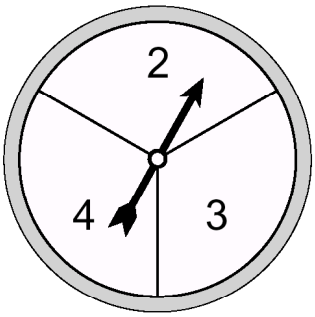
$P(H,H \mid \text{at least 1 H}) = \frac{P(\text{both})}{\text{2nd}}$

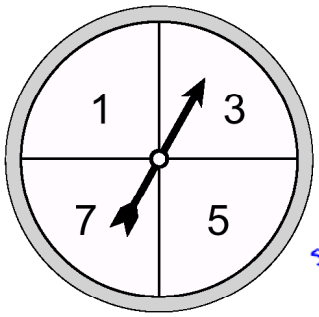
$= \frac{\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)}{\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)}$

$= \frac{1}{3}$

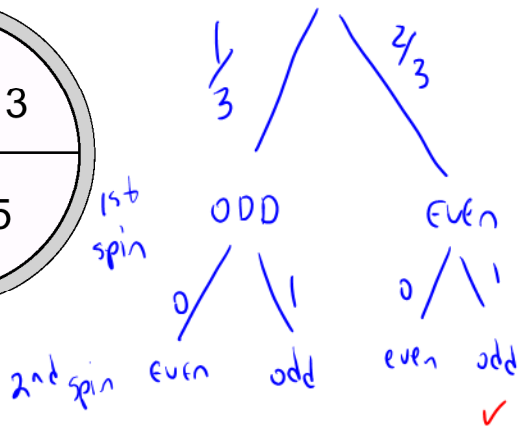
4.

In the diagram below, each spinner is spun once and the resulting numbers are added. What is the probability that the sum is an odd number?





1st spin



A. $\frac{5}{12}$

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{5}{7}$

To get an odd sum, we must have

(ODD + EVEN) or (even + odd)

$= \frac{2}{3} \times 1 = \frac{2}{3}$

5.

If a fair die is rolled 8 times, what is the probability of obtaining exactly two ⚄'s (5's)?

A. 0.11

B. 0.25

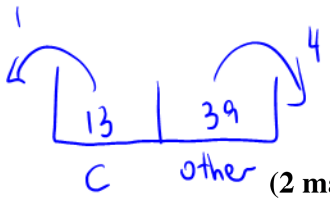
C. 0.26

D. 0.29

binompdf(8, 1/6, 2) = .26

6.

A hand of five cards is dealt from a standard deck of 52 cards.



a) What is the probability that the hand contains exactly 1 club? **(2 marks)**

b) What is the probability that the hand contains at most 1 club? **(2 marks)**

a) $\frac{{}_{13}C_1 \times {}_{39}C_4}{{}_{52}C_5} = .411$

b) P(0 clubs) or P(1 club)

$= \frac{{}_{13}C_0 \times {}_{39}C_5 + {}_{13}C_1 \times {}_{39}C_4}{{}_{52}C_5} = 0.633$

June 2003

7.

A card is randomly drawn from a standard 52-card deck. Determine the probability that the card drawn is a red ace.

A. $\frac{1}{26}$

B. $\frac{1}{13}$

C. $\frac{2}{13}$

D. $\frac{4}{13}$

$\frac{2}{52} = \frac{1}{26}$

8.

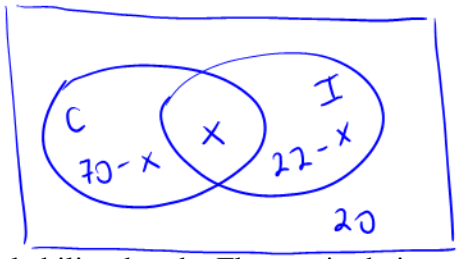
In a recent survey it was determined that out of 100 people, 70 had eaten Chinese food in the last year, 22 had eaten Italian food, and 20 had eaten neither. How many people had eaten both Chinese and Italian food in the last year?

A. 8

B. 10

C. 12

D. 28



$70 - x + x + 22 - x + 20 = 100$

$112 - x = 100$

$x = 12$

9.

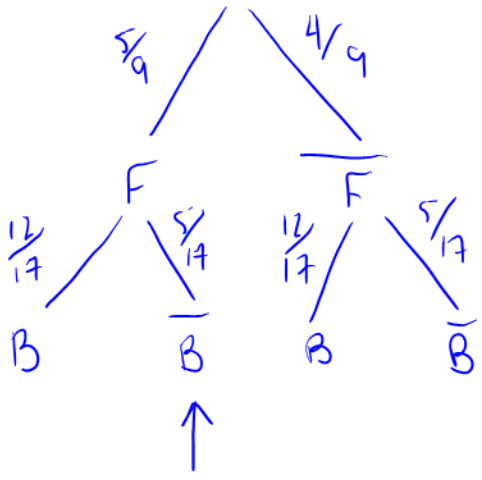
On Friday the probability that the Flyers win their game in Prince George is $\frac{5}{9}$ and the probability that the Bears win their game in Smithers is $\frac{12}{17}$. Assuming independence, what is the probability that on Friday the Flyers win their game and the Bears do not win their game?

A. $\frac{20}{153}$

B. $\frac{25}{153}$

C. $\frac{105}{153}$

D. $\frac{130}{153}$



$\frac{5}{9} \times \frac{5}{17} = \frac{25}{153}$

10.

Five balls are randomly drawn without replacement from a bag containing 4 red balls and 6 black balls. What is the probability that at least 3 red balls will be drawn?

A. 0.0238
B. 0.2381
C. 0.2619
D. 0.7381

4	6
R	B

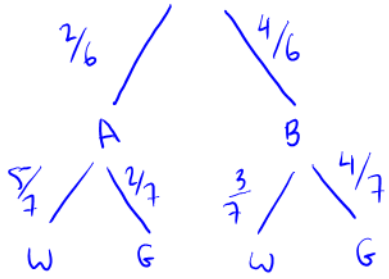
$$\frac{{}_4C_3 \times {}_6C_2 \quad \text{or} \quad {}_4C_4 \times {}_6C_1}{{}_{10}C_5} = 0.2619$$

11.

Bag A contains 5 white balls and 2 green balls. Bag B contains 3 white balls and 4 green balls. A fair die is rolled and if a 1 or 2 comes up, a ball is randomly selected from Bag A; however, if a 3, 4, 5 or 6 comes up, a ball is randomly selected from Bag B.

Bag A

Bag B



a) What is the probability of selecting a white ball? $\frac{2}{6} \times \frac{5}{7} + \frac{4}{6} \times \frac{3}{7} = \frac{11}{21}$ **(2 marks)**

b) If a white ball is selected, what is the probability that this ball came from Bag A? **(2 marks)**

$$P(A|W) = \frac{P(\text{both})}{P(W)} = \frac{\frac{2}{6} \times \frac{5}{7}}{\frac{11}{21}} = \frac{\frac{10}{42}}{\frac{11}{21}} = \frac{5}{11}$$

April 2003

12.

An experiment consists of tossing a fair coin and rolling a fair die. What is the probability of obtaining a head and a 5?

$$\left(\frac{1}{2}\right)\left(\frac{1}{6}\right) = \frac{1}{12}$$

A. $\frac{1}{12}$

B. $\frac{1}{10}$

C. $\frac{7}{12}$

D. $\frac{2}{3}$

13.

A multiple-choice test has 10 questions. Each question has 4 choices, only one of which is correct. If a student answers each question by guessing randomly, which expression below gives the probability that the student gets exactly 7 questions correct?

$n = 10 \quad x = 7 \quad p = \frac{1}{4} \quad q = \frac{3}{4}$

A. $\frac{({}_7C_4)({}_3C_3)}{{}_{10}C_7}$

B. $\frac{({}_4C_1)({}_4C_3)}{{}_{10}C_4}$

$${}_{10}C_7\left(\frac{1}{4}\right)^7\left(\frac{3}{4}\right)^3$$

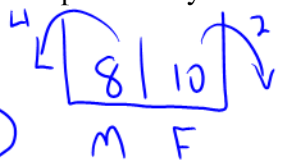
C. ${}_{10}C_7\left(\frac{1}{2}\right)^7\left(\frac{1}{2}\right)^3$

D. ${}_{10}C_7\left(\frac{1}{4}\right)^7\left(\frac{3}{4}\right)^3$

14.

Six people are randomly selected from a group of 8 males and 10 females to form a committee. Determine the probability that exactly 4 males are selected for this committee.

A. 0.01
B. 0.10
C. 0.17
D. 0.32



$$\frac{{}_8C_4 \times {}_{10}C_2}{{}_{18}C_6} = 0.1697$$

15.

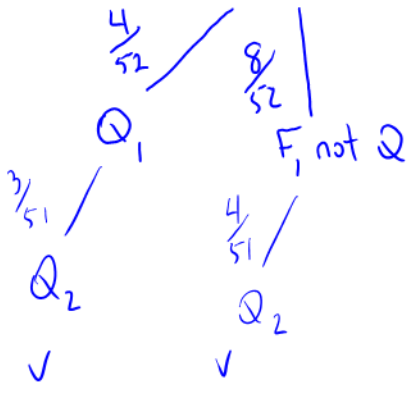
Two cards are drawn without replacement from a standard deck of 52 cards. What is the probability that the first card is a face card and the second card is a queen?

A. $\frac{11}{663}$

B. $\frac{3}{169}$

C. $\frac{3}{221}$

D. $\frac{4}{221}$

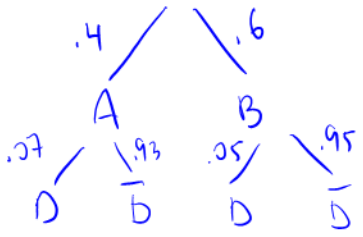


$= P(Q_1 \text{ and } Q_2)$ or $P(\text{face but not } Q_1, Q_2)$

$$= \frac{4}{52} \times \frac{3}{51} + \frac{8}{52} \times \frac{4}{51} =$$

16.

A building supply store buys 40% of its pine boards from sawmill A and 60% from sawmill B. Due to pine beetle infestation, 7% of the boards from sawmill A and 5% from sawmill B have a blue discoloration. If a randomly picked board is discoloured, what is the probability that it came from sawmill A? **(4 marks)**



$$P(A \mid D) = \frac{P(\text{both})}{P(D)}$$

$$= \frac{(.4)(.07)}{(.4)(.07) + .6(.05)} = 0.483$$

January 2003

17.

A golf putting machine is successful on 60% of its attempts at 4-metre putts. What is the probability that the machine will be successful on exactly eight of its next twelve 4-metre putts?

A. 0.04
B. 0.06
C. 0.21
D. 0.77

binompdf(12, .6, 8) = .21

or $12C8(.6)^8(.4)^4$

18.

Three cards are dealt from a standard deck of 52 cards. Determine the probability of getting at least one diamond.

A. 0.41
B. 0.44
C. 0.59
D. 0.75

P(at least 1) = 1 − P(0)

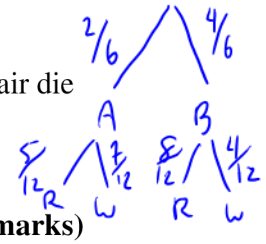
$= 1 - \frac{13C0\,39C3}{52C3} = .586$

0 | 13 | 39 | 3

D others

19.

Jar A contains 5 red balls and 7 white balls. Jar B contains 8 red balls and 4 white balls. A fair die is rolled. If a 1 or a 2 comes up, a ball is randomly selected from Jar A, otherwise, a ball is randomly selected from Jar B.



a) Find the probability that a white ball is selected. **(2 marks)**

$\frac{2}{6} \times \frac{7}{12} + \frac{4}{6} \times \frac{4}{12} = \frac{5}{12}$

b) Given that the ball selected is white, find the probability that it came from Jar A. **(2 marks)**

$P(A|W) = P(A \text{ and } W)/P(W) = \frac{2/6 \times 7/12}{5/12} = \frac{7}{15}$

20.

Two students, Peter and Ken, performed a simulation that involved the tossing of 3 coins. They recorded the number of heads and tails from 10 trials, as shown below.

Trial 1	HHT	Trial 6	THH
Trial 2	HHT	Trial 7	HTH
Trail 3	HTT	Trial 8	TTT
Trial 4	HHH	Trial 9	HHH
Trial 5	HTT	Trial 10	TTT

- According to the results from the simulation above, what is the experimental probability of getting 3 heads on a single trial? $\frac{2}{10}$

b) What is the theoretical probability of getting three heads on a single trial? Give your answer to three decimal places. $(\frac{1}{2})(\frac{1}{2})(\frac{1}{2}) = \frac{1}{8} = .125$

c) Use the binomial probability distribution formula to determine to three decimal places the theoretical probability of flipping exactly two sets of HHH in 10 trials.

binompdf(10, .125, 2) = .242

or $10C2(.125)^2(.875)^8$

21.

Of 15 rats in a cage, 5 have a blood disorder, another 6 have a bone disorder, and the remaining 4 are healthy. If 3 rats are randomly chosen from the cage, then the probability that all of the selected rats are healthy, correct to the nearest thousandth, is

5	6	4	3
Blood	Bone	Healthy	

A. 0.750

B. 0.267

C. 0.053

D. 0.009

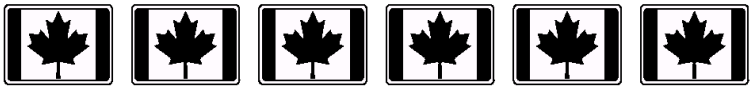
$$\frac{{}_4C_3 \times {}_5C_0 \times {}_6C_0}{{}_{15}C_3} = .0088$$

22.

Each letter of the word **CANADA** is placed on a card, as shown below.

C	A	N	A	D	A

These cards are shuffled thoroughly and then placed face down, as shown below.



When all of the cards are turned over, what is the probability that they will spell **CANADA**?

Total # of permutations: $\frac{6!}{3!} = 120$

A. $\frac{1}{36}$

B. $\frac{1}{120}$

Only 1 of these will spell CANADA

∴ $\frac{1}{120}$

C. $\frac{1}{240}$

D. $\frac{1}{720}$

23.

A hockey arena has seating that is divided into sections lettered from A to Z inclusive and AA to XX inclusive. Each section consists of 20 rows with 16 seats in each row. At a sold-out hockey game, it is announced that a prize will be given to a person sitting in Section JJ. If you are sitting in section JJ, then what is the probability that you will win the prize?

there are $20 \times 16 = 320$ seats in JJ.

A. $\frac{1}{50}$

B. $\frac{1}{320}$

$\therefore \frac{1}{320}$

C. $\frac{1}{16\,000}$

D. $\frac{1}{16\,640}$

24.

Four books, labelled W, X, Y, and Z, are placed randomly on a shelf. The probability that they are placed in alphabetical order, from left to right, is

↑ permutation

A. $\frac{1}{4}$

B. $\frac{1}{6}$

there are $4!$ permutations.

Only 1 is in alphabetical order.

C. $\frac{1}{24}$

$\therefore \frac{1}{4!} = \frac{1}{24}$

D. $\frac{1}{256}$

25.

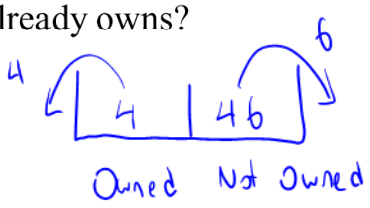
As a reward for signing up a new member for a music club, Alan will receive 10 different CDs from a list of 50 CDs. Alan already owns some of the 50 CDs on the list. What is the probability that a random selection of 10 different CDs from the list will include 4 CDs that Alan already owns?

A. $\frac{{}_4C_4 \times {}_{46}C_6}{{}_{50}C_{10}}$

B. $\frac{{}_4C_4 \times {}_{46}C_{10}}{{}_{50}C_{10}}$

C. $\frac{{}_{46}P_6}{{}_{50}P_{10}}$

D. $\frac{{}_{46}P_{10}}{{}_{50}P_{10}}$



$\frac{4C_4 \times 46C_6}{50C_{10}}$

26.

A certain soccer player has scored on 82% of his penalty kicks throughout his career. Given this information, the probability that he will score on exactly 4 of his next 5 penalty kicks, correct to the nearest hundredth, is

A. 0.80

B. 0.66

C. 0.41

D. 0.08

binompdf(5, .82, 4) = .407

or $5C_4(.82)^4(.18)^1$

27.

If $P(A) = \frac{3}{4}$ and $P(A \text{ and } B) = \frac{1}{2}$, where A and B are dependent events, then $P(B \mid A)$ equals

$P(B|A) = \frac{P(B \text{ and } A)}{P(A)} = \frac{1/2}{3/4} = 2/3$

A. $\frac{1}{4}$

B. $\frac{3}{8}$

C. $\frac{2}{3}$

D. $\frac{5}{4}$

28.

Use the following information to answer the next question.

Peter places the 5 equal-sized tiles shown below in a cloth bag.

P	E	T	E	R

Numerical Response

6. The probability that Peter selects the 5 tiles, one at a time, in order such that they spell **PETER**, correct to the nearest hundredth, is _____.

there are $\frac{5!}{2!} = 60$ permutations.

Only one of these spells "Peter"

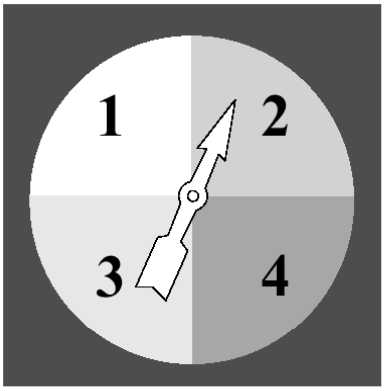
$\therefore \frac{1}{60} = .02$

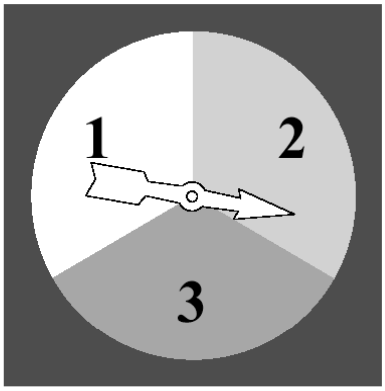
29.

Use the following information to answer the next question.

Probability of Independent Events

Two spinners are shown below. One has four equal-sized areas, and the other has three equal-sized areas. Assume that each spinner is spun once and that each arrow stops in one of the numbered areas.





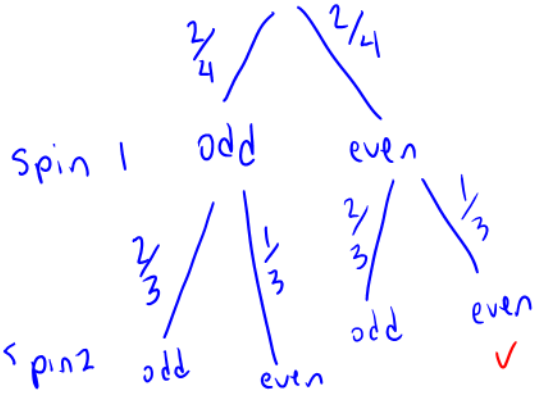
The probability that the sum of the numbers indicated by the arrows is an even number is

A. $\frac{1}{2}$

B. $\frac{3}{7}$

C. $\frac{1}{6}$

D. $\frac{2}{3}$



$\frac{2}{4} \times \frac{2}{3} + \frac{2}{4} \times \frac{1}{3} = \frac{6}{12}$

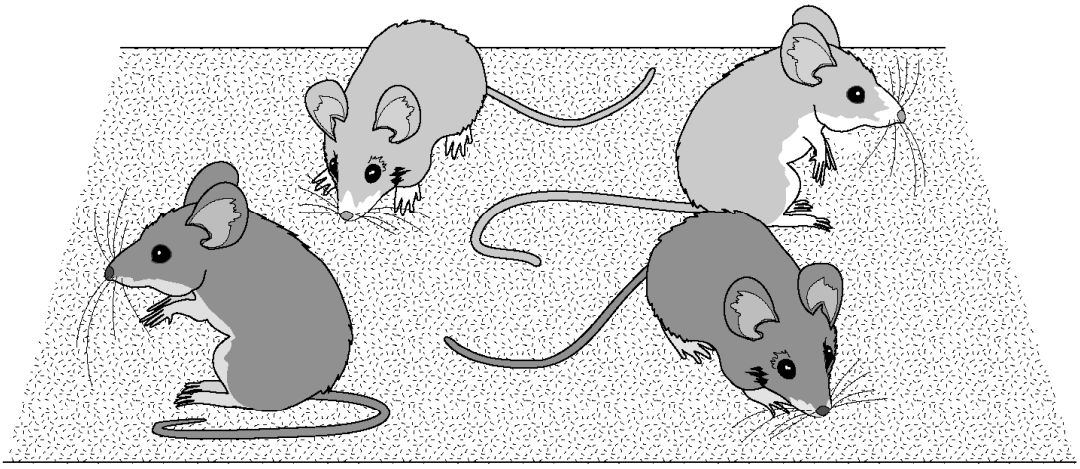
odd + odd = even

even + even = even

30.

Use the following information to answer the next question.

The breeding of yellow mice produces offspring that are either yellow or grey.



A student used Y to indicate a yellow mouse and G to indicate a grey mouse.

a) The student wrote YYGG to show the outcome of a breeding that produced 4 offspring. List all of the other outcomes that could exist for the four offspring, if order is not important.

omit question A

b) Yellow mice are genetic mutants and their breeding produces offspring that may not survive as a result of the mutation. Of the offspring that do survice, P(Grey) = 1/3 and P(Yellow) =2/3.

Determine the probability, to four decimal places, of the last two of the following outcomes:

The probability that 0 out of 4 survivors are grey is 0.1975.
The probability that 1 out of 4 survivors are grey is 0.3951.
The probability that 2 out of 4 survivors are grey is 0.2963.

The probability that 3 out of 4 survivors are grey is binompdf(4, 1/3, 3) = .0988.

The probability that 4 out of 4 survivors are grey is binompdf(4, 1/3, 4) = .0123

31.

From two vases that each contain purple and yellow tulips, a florist randomly selected two tulips. If the selection constituted an independent event, then the florist must have selected

A. one tulip from the first vase and one tulip from the second vase

B. one purple tulip and one yellow tulip from the second vase

C. two tulips of the same colour from the first vase

D. both tulips from the same vase

32.

> At a family reunion, door prizes are to be given out. At one table in the community hall, 6 children, 3 teenagers, 4 adults, and 5 seniors are seated. The 3 winning tickets are held by 3 different people at this table.

The probability that the 3 winning tickets are held by 3 people in the same age group, correct to the nearest thousandth, is

A. 0.037

B. 0.043

C. 0.222

D. 0.980

6	3	4	5
C	T	A	S

$P(3C)$ or $P(3T)$ or $P(3A)$ or $P(3S)$

$$= \frac{{}_6C_3 + {}_3C_3 + {}_4C_3 + {}_5C_3}{{}_{18}C_3} = 0.0429$$

33.
A child has 2 quarters, 2 dimes, and 3 nickels in his pocket, but he does not understand the value of any of the coins. He puts 35¢ worth of candy on the counter at a store and randomly selects two coins from his pocket. The probability that the two coins he selects will have a total value at least as high as the value of the candy is

2	2	3
Q	D	N

A. $\frac{2}{9}$

B. $\frac{5}{21}$

C. $\frac{12}{49}$

D. $\frac{2}{7}$

$P(2Q)$ or $P(Q,D)$

$$= \frac{{}_2C_2 \cdot {}_2C_0 \cdot {}_3C_0 + {}_2C_1 \times {}_2C_1 \times {}_3C_0}{{}_7C_2} = \frac{1+4}{21}$$

34.
A utility company has 11 power plants that generate electricity. The probability that any 1 of the 11 power plants will not be functioning at any given time is 0.10. The probability that exactly 3 of the 11 power plants will not be working at any one time, to the nearest thousandth, is

A. 0.300

B. 0.270

C. 0.165

D. 0.071

binompdf(11, .1, 3) = 0.071

or ${}_{11}C_3 (.1)^3 (.9)^8$

35. A particular machine in a factory produces many different coloured candies. The probability that a black candy is produced is 0.12. If the candies are packaged in boxes of 60, then what is the probability, to the nearest hundredth, that a box will contain at least 5 black candies?

P(at least 5) = 1 − P(4 or less)

= 1 − binomcdf(60, .12, 4) = 0.861

$n = 60$

$p = .12$

$x = 4$ or less

Answers:

1. C
2. C
3. B
4. C
5. C
6. a) 0.41 b)0.63
7. A
8. C
9. B
10. C
11. a)0.52 b)0.45
12. A
13. D
14. C
15. A
16. 0.48
17. C
18. C
19. a)5/12 b)7/15
20. a) .2 b) 0.125 c)0.242
21. d
22. b
23. b
24. c
25. a
26. c
27. c
28. 0.02
29. a
30. b) 0.0988, 0.0123
31. a
32. b
33. b
34. d
35. 0.86

Formulae:

$$P(\overline{A}) - 1 - P(A)$$

$$P(AorB) = P(A) + P(B) - P(AandB)$$

$$P(A|B) = \frac{P(AandB)}{P(B)}$$

$$P(AandB) = P(A) \times P(B|A)$$

Note to teachers:

The questions here come from a variety of sources. Most come from Alberta provincial exams, or are based on questions from those documents. A few came from some of my university texts.

I generally hand this out at the beginning of the unit (including the answer key), and I collect it the day of the test. I flip through the booklet just to see if there is writing on each page, and I give the students a few marks. During the unit, I have a few photocopied solution manuals (showing all my steps) floating around the class as well. Students can sign them out and take them home if they wish.

If you find any errors in the answer key, or have any suggestions that I could add, feel free to email me at kdueck@sd42.ca and I'll be happy to reply.

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PS Thanks to Gretchen McConnell for helping with error checking my answer keys! It's been much appreciated!