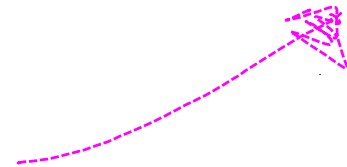If someone rolls 2 die, what is the probability they <u>don't</u> roll a pair of 3's ?

← Warm UP

Toss 4 COINS

what is the probability of getting exactly 2 tails.

Questions on HW ???

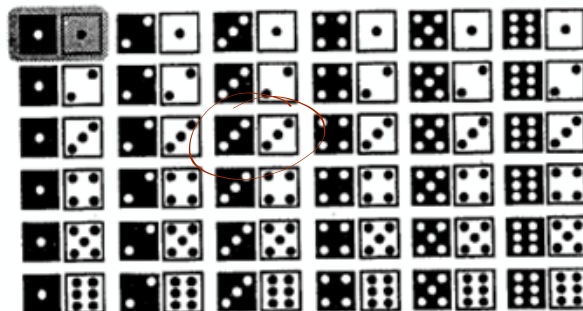AND FINALLY, A *SUBTRACTION RULE:* FOR ANY EVENT E,

$$P(E) = 1 - P(NOT\ E)$$

THIS IS USEFUL WHEN P(NOT E) IS EASIER TO COMPUTE THAN P(E). FOR INSTANCE, LET **E** BE THE EVENT, A DOUBLE-1 IS *NOT THROWN.* THE EVENT NOT-E, A DOUBLE-1 *IS* THROWN, HAS PROBABILITY $P(NOT\ E) = \frac{1}{36}$.

SO

$P(E) = 1 - P(NOT\ E)$

$\quad = 1 - \frac{1}{36}$

$\quad = \frac{35}{36}$

Complementary Events

$$P(\text{rains}) = 1 - P(\text{does not rain})$$

$$P\left(\begin{array}{c}\text{it does}\\\text{not snow}\end{array}\right) = 1 - P(\text{it snows})$$

$$P(E) = 1 - P(E')$$

TOSS 4 COINS at a time

Listing the Sample Space

What is the probability of getting exactly 2 tails?
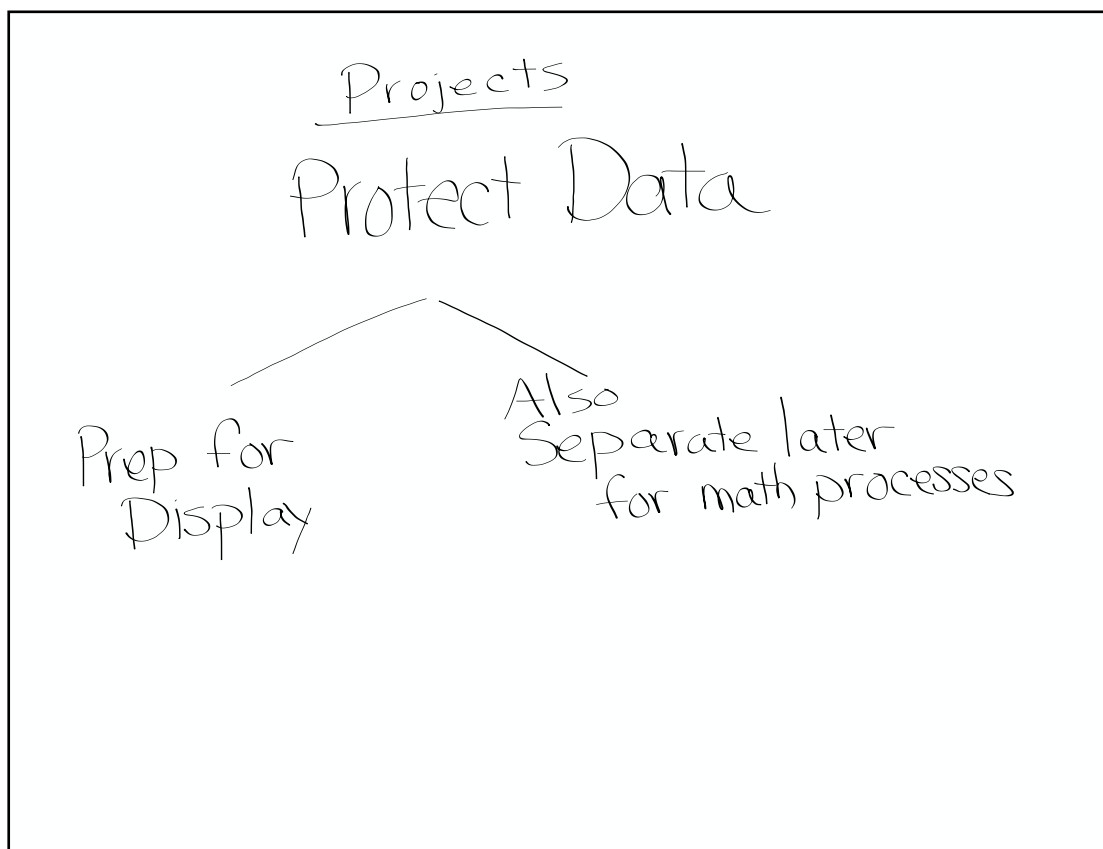
Strategy: List all of the outcomes

HHH HHT TTH TTT
     HTH THT
     THH HTT

being systematic
can be helpful

TTTT HTTT HHTT HHHT HHHH
      THTT HTHT HHTH
      TTHT HTTH HTHH
      TTTH TTHH THHH
            THTH
            THHT

P(exactly two tails) = $\frac{6}{16}$

<u>Projects</u>

Protect Data

Prep for
Display

Also
Separate later
for math processes

1. Enter raw data into a spreadsheet.

2. *Separate* Adjust the headers to minimize width
   - Wrap text if necessary.
   - Adjust width so you can see text and numbers

3. Copy all columns and paste into a new <u>section</u> of spreadsheet.

New Data Table for Draft 2 and Final Draft ☆ 📁

File   Edit   View   Insert   Format   Data   Tools   Add-ons   Help   Last edit was

100%   ▾ $ %   .0   .00   123 ▾   Arial   ▾   14   ▾   **B**

fx   Rank (Density of Restaurants)

	A	B	C	D	E
1	Rank (Dens of Restaura	State	McDonald's Loca per 100,000 Pe	% of Population With Diabetes	
2	1	Ohio	7.1	11.10%	
3	2	Michigan	6.4	11.20%	
4	3	Kansas	6.3	9.40%	
5	4	Maryland	6.3	10.80%	
6	5	Louisiana	6.3	12.10%	
7	6	Arkansas	6.2	13.50%	
8	7	Missouri	6.1	11.50%	
9	8	Tennessee	6	12.70%	
10	9	Indiana	5.9	11.50%	
11	10	Wisconsin	5.9	9.80%	
12	11	Kentucky	5.9	13.10%	
13	12	Alabama	5.8	14.60%	
14	13	Illinois	5.7	10.40%	
15	14	Oklahoma	5.6	12.00%	
16	15	Iowa	5.6	9.30%	
17	16	Wyoming	5.5	8.30%	

4. Decide on a reasonable font size (not too small).

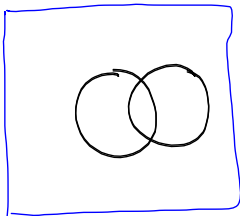6. Consider splitting the page if you have ≥ 4 pages of data.
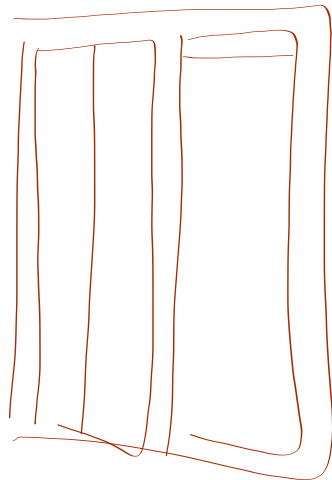
- Questions on the Homework ?

Check HW
from Fri

---

p. 80 . . . . ●* 9

factory 56 workers , 47 day shift , 29 night shift

EXERCISE 14C P.461 ●● 1

1 The table shows data from a survey conducted at five schools on the rate of smoking amongst 15 year old students.

| School	No. of 15 year olds		No. of smokers	
	Male	Female	Male	Female
A	45	51	10	11
B	36	42	9	6
C	52	49	13	13
D	28	33	9	10
E	40	39	7	4
Total	201	214	48	44

a What is the probability that a randomly chosen female 15 year old student at school C is a smoker?

b What is the probability that a randomly chosen 15 year old student at school E is a smoker?

c If a 15 year old is chosen at random from the five schools, what is the probability that he or she is a smoker?

P.456 ●● 3

3 Betul keeps records of the number of phone calls she receives over a period of consecutive days.

a For how many days did the survey last? 43

b Estimate Betul's chance of receiving:

  i no phone calls on one day

  ii 5 or more phone calls on a day

  iii less than 3 phone calls on a day.
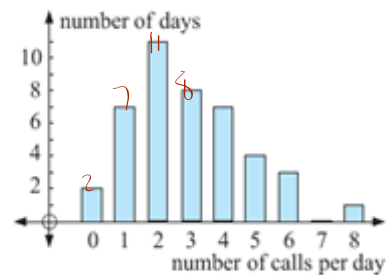
465

#37

How many possible three child families?

GGG   GGB   GBB   BBB
           GBG   BGB
           BGG   BBG

EXERCISE 14C

1 The table shows data from a survey conducted at five schools on the rate of smoking amongst 15 year old students.

$\frac{13}{49} = 0.265$

a What is the probability that a randomly chosen female 15 year old student at school **C** is a smoker?

b What is the probability that a randomly chosen 15 year old student at school **E** is a smoker?

c If a 15 year old is chosen at random from the five schools, what is the probability that he or she is a smoker?

| School	No. of 15 year olds		No. of smokers	
	Male	Female	Male	Female
A	45	51	10	11
B	36	42	9	6
C	52	49	13	13
D	28	33	9	10
E	40	39	7	4
Total	201	214	48	44

$\frac{7+4}{40+39}$

$= \frac{11}{79} = 0.139$

$\frac{48+44}{201+214} = 0.222$

p.465

4 A dart board has 36 sectors, labelled 1 to 36. Determine the probability that a dart thrown at the board hits:

a   a multiple of 4

b   a number between 6 and 9 inclusive

c   a number greater than 20

d   9

e   a multiple of 13

f   an odd number that is a multiple of 3.
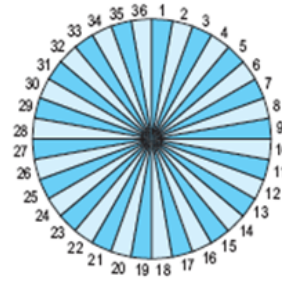
6 List the six different orders in which Antti, Kai and Neda may sit in a row. If the three of them sit randomly in a row, determine the probability that:

a   Antti sits in the middle

b   Antti sits at the left end

c   Antti sits at the right end

d   Kai and Neda are seated together

1 When a batch of 145 paper clips were dropped onto 6 cm by 6 cm squared paper it was observed that 113 fell completely inside squares and 32 finished up on the grid lines. Find, to 2 decimal places, the estimated probability of a clip falling:

  a inside a square   **b** on a line.

6 cm   on   inside   6 cm

$\frac{113}{145} = .7793\ldots = 0.779$ .78   ← 3 sig.figs
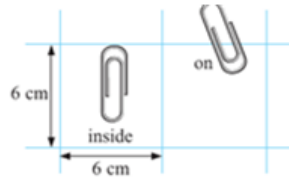
$\frac{32}{145} = 0.2206\ldots = 0.221$ .22

2

Length	Frequency
0 - 19	17
20 - 39	38
40 - 59	19
60+	4

78

Jose surveyed the length of TV commercials (in seconds). Find to 3 decimal places the estimated probability that a randomly chosen TV commercial will last:

 a 20 to 39 seconds   **b** more than a minute
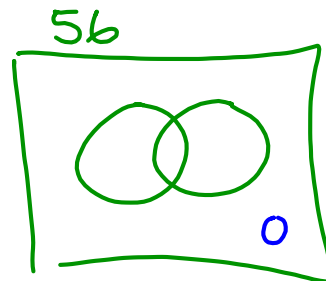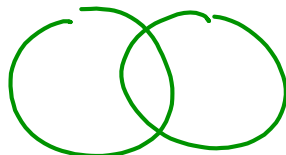 **c** between 20 and 59 seconds (inclusive)

a) $\frac{38}{78} \doteq 0.487$ b) $\frac{4}{78} = 0.051$

c) $\frac{38+19}{78} = 0.731$

p. 80
9

56 people factory   47 day   29 night

56

0

⬤⬤ = ○ + ○ − ⬤

56 = 47 + 29 −

p.465

#6

a) $\frac{2}{9}$
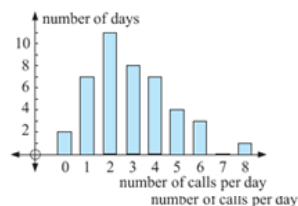
AKN ANK KAN KNA NAK NKA

---

3 Betul keeps records of the number of phone calls she receives over a period of consecutive days.

a For how many days did the survey last?

b Estimate Betul's chance of receiving:
  i no phone calls on one day
  ii 5 or more phone calls on a day
  iii less than 3 phone calls on a day.

number of days

number of calls per day

2+7+11+
8+7+4+
3+0+1
= 43 days

i) $P(0) = \frac{2}{43} = 0.047$

ii) $P(\geq 5 \text{ calls}) = \frac{4+3+0+1}{43} = \frac{10}{43} = .186$

iii) $P(<3) = \frac{2+7+11}{43} = \frac{20}{43} = 0.465$

4 Pat does a lot of travelling in her car and she keeps records on how often she fills her car with petrol. The table alongside shows the frequencies of the *number of days between refills*. Estimate the like-lihood that:

a there is a four day gap between refills

b there is at least a four day gap between refills.

Days between refills	Frequency
1	37
2	81
3	48
4	17
5	6
6	1

Total frequency
= 37+81+48+17+6+1
= 190

a) $\frac{17}{190} = 0.089$

b) $\frac{17+6+1}{190} = 0.126$

2 The given table shows complaints received by the Telecommunications Ombudsman concerning internet services over a four year period.

Reason	1998/99	1999/00	2000/01	2001/02
Access	585	1127	2545	-
Billing	1822	2102	3136	3582
Contracts	242	440	719	836
Credit control	3	44	118	136
Customer Service	12	282	1181	1940
Disconnection	n/a	n/a	n/a	248
Faults	86	79	0	2384
Privacy	93	86	57	60
Provision	172	122	209	311
Total	3015	4282	7965	9497

a What is the probability that a complaint received in 2000/01 is about customer service?

$$\frac{1181}{7965} = 0.148$$

b What is the probability that a complaint received at any time during the 4 year period related to billing?

$$\frac{1822 + 2102 + 3136 + 3582}{3015 + 4282 + 7965 + 9497} = 0.430$$

c What is the probability that a complaint received in 2001/02 did *not* relate to either billing or faults?

$$\frac{836 + 136 + 1940 + 248 + 60 + 311}{9497} = 0.372$$

Next Test

Quiz this Friday (Nov. 1)

Sets/VennDiag/Probability

Goal:

Finding Compound
Probabilities

handout

---

or

and

A or B

A and B

can get
complicated

INDEADENT EVENTS

Independent events are events where the occurrence of one of the events **does not** affect the occurrence of the other event.

If A and B are **independent events** then   P(A **and** B) = P(A) × P(B).

Also:

If A, B and C are all **independent events**, then
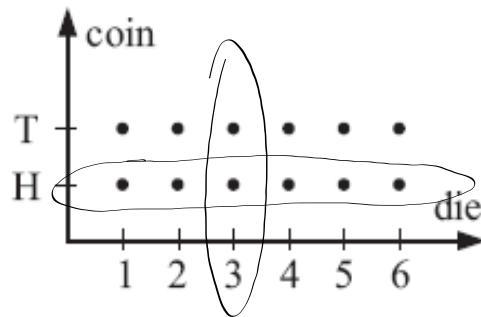P(A **and** B **and** C) = P(A) × P(B) × P(C).

Ⓔ **Example:**

A coin and a die are tossed simultaneously. Determine the probability of getting a head and a 3 without the sample space

$$P(h \text{ and } 3)$$

$$\frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$$

Ⓕ **Rain Example**

At a mountain village in New Guinea it rains on average 6 days a week. Determine the probability that it rains on:

a any one day $\frac{6}{7}$

b two successive days

$$P\left(\begin{array}{c}\text{rain} \\ \text{on} \\ \text{1st}\end{array} \text{ and } \begin{array}{c}\text{rain} \\ \text{on} \\ \text{2nd day}\end{array}\right)$$

c three successive days. $\frac{6}{7} \times \frac{6}{7} \times \frac{6}{7}$ $\left(\frac{6}{7}\right)^3$

G **Target Example**

Two marksmen fire at a target simultaneously. Jiri hits the target 70% of the time and Benita hits it 80% of the time. Determine the probability that:

a they both hit the target

$(.70)(.80) = .56 = 56\%$

$$\frac{7}{10} \cdot \frac{8}{10} = \frac{56}{100}$$

b they both miss the target

$$\frac{3}{10} \cdot \frac{2}{10} = \frac{6}{100}$$

c Jiri hits it but Benita misses

$$\frac{7}{10} \cdot \frac{2}{10} = \frac{14}{100}$$

d Benita hits it but Jiri misses.

$$\frac{8}{10} \cdot \frac{3}{10} = \frac{24}{100}$$

I **CONDITIONAL PROBABILITY Situation:**

Suppose you are dealt two cards. What is the probability that <u>both</u> are Spades?

$$P\left(\begin{array}{c} 1^{st} \\ \text{card} \\ \text{is a} \\ \text{spade} \end{array} \text{ and } \begin{array}{c} 2^{nd} \\ \text{card is} \\ \text{a spade} \end{array}\right) = \frac{13}{52} \times \frac{12}{51} = \boxed{\frac{1}{17}}$$

BB

+ Lottery

☺

CONDITIONAL PROBABILITY:
Event #2 is affected by Event #1

The chance of getting 1 Spade is 13/52 since:
There are 13 total spades and 52 total cards

IMPORTANT: Probability has changed!!
After getting Spade #1, there are only 12
Spades left and there are only 51 cards left.
Probability of the second spade   12/51

CONDITIONAL PROBABILITY :
Multiplication

Probability (Spade #1) times Probability
(Spade 2)

$$\frac{13}{52} \cdot \frac{12}{51} = .0588$$

(A)

DEPENDENT EVENTS

Two or more events are **dependent** if they are **not independent**.

Dependent events are events where the occurrence of one of the events *does affect* the occurrence of the other event.

If A and B are <u>dependent</u> events

then

$$P(A, \text{then } B) = P(A \text{ given that } A \text{ has occured})$$

B.B

Assignment #5
due tomorrow,

p.466 … 9

p.468 … 1, 3cefg

p.471 … 2-3

p.473 … 1