

5. (b) There are 4 dice, so the probability of a 1 is multiplied by the 4 ways of getting a 1.
- (c) $\left(\frac{1}{2}\right)^4 = \frac{1}{16}$ (d) $\frac{3}{8}$
- (e) 0: $\frac{1}{16}$, 1: $\frac{1}{4}$, 2: $\frac{3}{8}$, 3: $\frac{1}{4}$, 4: $\frac{1}{16}$ (f) $\frac{1}{16}$
7. (a) 0.243 (b) 3 (c) 0.595
8. (a) $\frac{15}{64}$ or 0.234 (b) $\frac{57}{64}$ or 0.891 (c) $\frac{1}{64}$ or 0.016
9. (a) 0.132 (b) 0.168 (c) 3.5 (d) 0.002
10. (a) (i) 0.138 (ii) 0.562 (iii) 0.034 (b) 2.8
11. (a) 0.013 (b) 0.350 (c) (a) 1 (b) 3
12. 0.008
13. 0.271
14. 0.037

5.4 Exercises, page 311

1. (a) 0.25 (b) 0.375 (c) 0.25 (d) 0.063 (has been rounded off) (e) 0.063 (has been rounded off)
2. (a) 0.323 011 (b) 0.290 710 (c) 0.155 045 (d) 0.054 266 (e) 0.013 024 (f) 0.002 171
3. (a) 0.410 (b) 0.819
4. 0.026 424
5. (a) 0.120 (b) approximation: 0.251, exact: 0.252
6. (a) 0.091 (b) approximation: 0.201, exact: 0.203
7. (a) 0.132 (b) approximation: 0.433, exact: 0.417 (c) approximation: 0.034, exact: 0.024
8. approximation: 0.019, exact: 0.016
9. Ten or more doubles are more likely.
10. (a) (i) approximation: 0.556, exact: 0.556 (ii) approximation: 0.000, exact: 0.0001 (b) (i) approximation: 0.898, exact: 0.899 (ii) approximation: 0.005, exact: 0.006
11. 0.500
12. approximation: 0.0392, exact: 0.0281
13. (a) exact: 0.204; exact: 0.006 (b) 6
14. not likely
15. not likely

5.5 Exercises, page 321

1. (a) 7: $\frac{15}{61}$, 8: $\frac{19}{61}$, 9: $\frac{12}{61}$, 10: $\frac{7}{61}$, 11: $\frac{5}{61}$, 12: $\frac{2}{61}$, 13: $\frac{1}{61}$ (b) 1: $\frac{1}{48}$, 2: $\frac{7}{48}$, 3: $\frac{11}{48}$, 4: $\frac{13}{48}$, 5: $\frac{9}{48}$, 6: $\frac{5}{48}$, 7: $\frac{2}{48}$, 8: $\frac{0}{48}$ (c) 3: $\frac{1}{42}$, 4: $\frac{1}{42}$, 5: $\frac{5}{42}$, 6: $\frac{8}{42}$, 7: $\frac{15}{42}$, 8: $\frac{12}{42}$ (d) 10: $\frac{2}{38}$, 11: $\frac{7}{38}$, 12: $\frac{10}{38}$, 13: $\frac{6}{38}$, 14: $\frac{8}{38}$, 15: $\frac{5}{38}$
2. Answers may vary; for example:

X	1	2	3	4	5	6	7	8	9	10
Frequency	8	5	6	6	2	2	3	4	2	12

3. 1: $\frac{8}{50}$, 2: $\frac{5}{50}$, 3: $\frac{6}{50}$, 4: $\frac{6}{50}$, 5: $\frac{2}{50}$, 6: $\frac{2}{50}$, 7: $\frac{3}{50}$, 8: $\frac{4}{50}$, 9: $\frac{2}{50}$, 10: $\frac{12}{50}$
6. (a) 0: $\frac{44}{61}$, 1: $\frac{8}{61}$, 2: $\frac{4}{61}$, 3: $\frac{2}{61}$, 4: $\frac{1}{61}$, 5: $\frac{0}{61}$, 6: $\frac{1}{61}$, 7: $\frac{1}{61}$ (b) 0.195 (c) $\frac{39}{61}$ or 0.639
7. (a)
- | X | 1 | 2 | 3 | 4 |
|-----------|---|---|---|---|
| Frequency | 3 | 6 | 9 | 7 |
- (b) 1: $\frac{3}{25}$, 2: $\frac{6}{25}$, 3: $\frac{9}{25}$, 4: $\frac{7}{25}$ (c) 2.8
8. Answers may vary; for example, $\frac{8}{20}$ or 0.40.

9. Answers may vary; for example, $\frac{7}{20}$ or 0.35.
10. $P(18 \text{ tails}) = 0.0002$, so the coin is likely biased.
11. $P(\text{miss 4 of 5}) = 0.0064$; the coach should be concerned.
12. $P(\text{guess 7 of 10}) = 0.117$; no
13. (a) 0.0702 (b) The probability changes as each jellybean is drawn. (c) 0: 0.583 752, 1: 0.339 391, 2: 0.070 219, 3: 0.006 384, 4: 0.000 251, 5: 0.000 003 (e) 0.5
14. (a) 0 (b) 0 (c) 1
15. Answers may vary; for example: 14
16. 23

Chapter 5 Wrap-Up, page 324

1. (a) Let X be winnings (\$). (b) $E(X) = \$1.75$
- | X | 0 | 2 | 5 |
|------|---------------|---------------|---------------|
| P(X) | $\frac{1}{2}$ | $\frac{1}{4}$ | $\frac{1}{4}$ |
- (c) No, since in a fair game the expected winnings would be the same as the cost of playing.
2. (a) 0.96 (b) 2.22
3. (a) 330 (b) 8
4. (a) $243x^5 + 1620x^4y + 4320x^3y^2 + 5760x^2y^3 + 3840xy^4 + 1024y^5$ (b) $64x^{18} - 576x^{17} + 2160x^{16} - 4320x^{15} + 4860x^{14} - 2916x^{13} + 729x^{12}$ (c) $125 - \frac{150}{x} + \frac{60}{x^2} - \frac{8}{x^3}$ (d) $x^4 + 4x^{3.5} + 6x^3 + 4x^{2.5} + x^2$
5. (a) 9 (b) 20 412 (c) $-1512x^{12}$
6. (a) $\frac{74}{21}$ (b) 20 349
7. (a) 0.246 (b) 0.044 (c) 0.044 (d) 0.989
8. (a)
- ```

graph LR
 A[] --- B[red ball]
 A --- C[blue ball]
 A --- D[green ball]
 B --- E[heads
tails]
 C --- F[heads
tails]
 D --- G[heads
tails]

```
- (c)  $\frac{3}{10}$
- (d) Yes, since the experiment consists of only one trial.
9. 0.407
10. (a) 0.058 (b) 0.016 (c) 0.188 (d) 0.000 001
11. (a) 0.001 (b) 0.570
12. (a) 0.330 (b) 0.4
13. (a) 0.396 (b) No, because the probabilities change every time a marble is drawn. (c) 0: 0.008, 1: 0.110, 2: 0.371, 3: 0.396, 4: 0.115 (e) 2.5
14. (a) 0.002

## Chapter 5 Test, page 326

1. (a) Time in minutes if transaction times with tellers during a 2-h period (b) 1:  $\frac{2}{5}$ , 2:  $\frac{6}{25}$ , 3:  $\frac{9}{50}$ , 4:  $\frac{1}{10}$ , 5:  $\frac{3}{50}$ , 6:  $\frac{1}{50}$  (c) 2.24 min
2. (a) 0.06 (b) 0.724 (c) 0.419
3. (b) 0.659
4. Bernoulli trials are for two outcomes only; the probability of each outcome remains the same from trial to trial; the trials are independent of each other.
5.  $2^9 \left(\frac{15}{9}\right)x^{7.5}$
6. 27
7.  $a^3 + b^3 + c^3 + 3a^2b + 3a^2c + 3ab^2 + 3ac^2 + 3b^2c + 3bc^2 + 6abc$
8. Theoretically, simulations are never perfect.