

## Answers to Selected Exercises

### 13. Games of Chance

- 2. **Poker**
  - 3. **Poker Dice**
  - 4. **Craps**
  - 7. **Lotteries**
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#### 2. Poker

- 2.14. 0.0287
- 2.15.  $3.913 \text{ E}-10$
- 2.16. Ordinal. No.
- 2.17.  $\frac{32}{1081}$
- 2.18.  $\frac{48}{1081}$

#### 3. Poker Dice, Chuck-A-Luck, and High-Low

- 3.12. 0.2130
- 3.20.  $\mathbb{P}(Z = h) = \frac{15}{36}$ ,  $\mathbb{P}(Z = l) = \frac{15}{36}$ ,  $\mathbb{P}(Z = s) = \frac{6}{36}$ , where  $h$  denotes high,  $l$  denotes low, and  $s$  denotes seven.
- 3.21. Let  $W$  denote the net winnings on a unit bet in high-low.
  - a. Bet high:  $\mathbb{E}(W) = -\frac{1}{6}$ ,  $\text{var}(W) = \frac{35}{36}$
  - b. Bet low:  $\mathbb{E}(W) = -\frac{1}{6}$ ,  $\text{var}(W) = \frac{35}{36}$
  - c. Bet seven:  $\mathbb{E}(W) = -\frac{1}{6}$ ,  $\text{var}(W) = \frac{7}{2}$

#### 4. Craps

- 4.35. 0.09235

#### 7. Lotteries

- 7.3.  $\mathbb{E}(U) = 0.5319148936$ ,  $\text{sd}(U) = 0.6587832083$

$k$	$\mathbb{P}(U = k)$
0	0.5545644253
1	0.3648450167

2	0.0748400034
3	0.0056130003
4	0.0001369024
5	0.0000006519

7.4.  $\mathbb{E}(U) = 0.5102040816$ ,  $\text{sd}(U) = 0.6480462207$

$k$	$\mathbb{P}(U = k)$
0	0.5695196981
1	0.3559498113
2	0.0694536217
3	0.0049609730
4	0.0001153715
5	0.0000005244

7.5.  $\mathbb{E}(U) = 1.042553191$ ,  $\text{sd}(U) = 0.8783776109$

$k$	$\mathbb{P}(U = k)$
0	0.2964400642
1	0.4272224454
2	0.2197144005
3	0.0508598149
4	0.0054983583
5	0.0002604486
6	0.0000044521
7	0.0000000159

7.8. Joint distribution of  $(I, U)$

$\mathbb{P}(I = i, U = k)$		$i$	
		0	1
$k$	0	0.5340250022	0.0205394232
	1	0.3513322383	0.0135127784
	2	0.0720681514	0.0027718520
	3	0.0054051114	0.0002078889
	4	0.0001318320	0.0000050705
	5	0.0000006278	0.0000000241

7.9. Joint distribution of  $(I, U)$

$\mathbb{P}(I = i, U = k)$		$i$	
		0	1
$k$	0	0.5559597053	0.0135599928
	1	0.3474748158	0.0084749955
	2	0.0677999641	0.0016536577
	3	0.0048428546	0.0001181184
	4	0.0001126245	0.0000027469
	5	0.0000005119	0.0000000125

In the following keno exercises, let  $V$  denote the random pay off on a unit bet.

- 7.13. Pick  $m = 1$ ,  $\mathbb{E}(V) = 0.75$ ,  $\text{sd}(V) = 1.299038106$

$v$	$\mathbb{P}(V = v)$
0	0.75
3	0.25

- 7.14. Pick  $m = 2$ ,  $\mathbb{E}(V) = 0.7353943525$ ,  $\text{sd}(V) = 5.025285956$

$v$	$\mathbb{P}(V = v)$
12	0.0601265822

- 7.15. Pick  $m = 3$ ,  $\mathbb{E}(V) = 0.7353943525$ ,  $\text{sd}(V) = 5.025285956$

$v$	$\mathbb{P}(V = v)$
0	0.8473709834
1	0.1387536514
43	0.0138753651

- 7.16. Pick  $m = 4$ ,  $\mathbb{E}(V) = 0.7406201394$ ,  $\text{sd}(V) = 7.198935911$

$v$	$\mathbb{P}(V = v)$
0	0.7410532505
1	0.2126354658
3	0.0432478914
130	0.0030633923

- 7.17. Pick  $m = 5$ ,  $\mathbb{E}(V) = 0.7207981892$ ,  $\text{sd}(V) = 20.33532453$

$v$	$\mathbb{P}(V = v)$
0	0.9033276850

1	0.0839350523
10	0.0120923380
800	0.0006449247

7.18. Pick  $m = 6$ ,  $\mathbb{E}(V) = 0.7315342885$ ,  $\text{sd}(V) = 17.83831647$

$v$	$\mathbb{P}(V = v)$
0	0.8384179112
1	0.1298195475
4	0.0285379178
95	0.0030956385
1500	0.0001289849

7.19. Pick  $m = 7$ ,  $\mathbb{E}(V) = 0.7196008747$ ,  $\text{sd}(V) = 40.69860455$

$v$	$\mathbb{P}(V = v)$
0	0.9384140492
1	0.0521909668
25	0.0086385048
350	0.0007320767
8000	0.0000244026

7.20. Pick  $m = 8$ ,  $\mathbb{E}(V) = 0.7270517606$ ,  $\text{sd}(V) = 55.64771986$

$v$	$\mathbb{P}(V = v)$
0	0.9791658999
9	0.0183025856
90	0.0023667137
1500	0.0001604552
25,000	0.0000043457

7.21. Pick  $m = 9$ ,  $\mathbb{E}(V) = 0.7486374371$ ,  $\text{sd}(V) = 48.91644787$

$v$	$\mathbb{P}(V = v)$
0	0.9610539663
4	0.0326014806
50	0.0057195580
280	0.0005916784
4000	0.0000325925

50,000	0.0000007243
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- 7.22. Pick  $m = 10$ ,  $\mathbb{E}(V) = 0.7228896221$ ,  $\text{sd}(V) = 38.10367609$

$v$	$\mathbb{P}(V = v)$
0	0.9353401224
1	0.0514276877
22	0.0114793946
150	0.0016111431
1000	0.0001354194
5000	0.0000061206
100,000	0.0000001122

- 7.23. Pick  $m = 11$ ,  $\mathbb{E}(V) = 0.7138083347$ ,  $\text{sd}(V) = 32.99373346$

$v$	$\mathbb{P}(V = v)$
0	0.9757475913
8	0.0202037345
80	0.0036078097
400	0.0004114169
2500	0.0000283736
25,000	0.0000010580
100,000	0.0000000160

- 7.24. Pick  $m = 12$ ,  $\mathbb{E}(V) = 0.7167721544$ ,  $\text{sd}(V) = 20.12030014$

$v$	$\mathbb{P}(V = v)$
0	0.9596431653
5	0.0322088520
32	0.0070273859
200	0.0010195984
1000	0.0000954010
5000	0.0000054280
25,000	0.0000001673
100,000	0.0000000021

- 7.25. Pick  $m = 13$ ,  $\mathbb{E}(V) = 0.7216651326$ ,  $\text{sd}(V) = 22.68311303$

$v$	$\mathbb{P}(V = v)$
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0	0.9213238456
1	0.0638969375
20	0.0123151493
80	0.0021831401
600	0.0002598976
3500	0.0000200623
10,000	0.0000009434
50,000	0.0000000240
100,000	0.0000000002

7.26. Pick  $m = 14$ ,  $\mathbb{E}(V) = 0.7194160496$ ,  $\text{sd}(V) = 21.98977077$

$v$	$\mathbb{P}(V = v)$
0	0.898036333063
1	0.077258807301
9	0.019851285448
42	0.004181636518
310	0.000608238039
1100	0.000059737665
8000	0.000003811015
25,000	0.000000147841
50,000	0.000000003084
100,000	0.000000000026

7.27. Pick  $m = 15$ ,  $\mathbb{E}(V) = 0.7144017020$ ,  $\text{sd}(V) = 24.31901706$

$v$	$\mathbb{P}(V = v)$
0	0.95333046038902
1	0.00801614417729
10	0.02988971956684
25	0.00733144064847
100	0.00126716258122
300	0.00015205950975
2800	0.00001234249267
25,000	0.00000064960488
50,000	0.00000002067708

100,000	0.00000000035046
100,000	0.0000000000234

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