Theta Probability Solutions

1. $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4} \rightarrow C$

2. $1 - P(\text{neither}) = 1 - \left(\frac{1}{2} \times \frac{1}{2}\right) = \frac{3}{4} \rightarrow C$

3. 1-5, 2-4, 3-3, 4-2, 5-1 → 5 ways; $\frac{5}{5^2} \rightarrow \frac{1}{5} \rightarrow B$

4. Last game must be Mariners' win, others in any order.

$$\binom{6}{3} \times \left(\frac{2}{3}\right)^4 \left(\frac{1}{3}\right)^3 = \frac{320}{2187} \rightarrow C$$

5. $1 - P(\text{no defective found}) = 1 - \left(\frac{66}{72} \times \frac{65}{71} \times \frac{64}{70} \times \frac{63}{69}\right) = \frac{489}{1633} \rightarrow C$

6. After 1st card drawn, 25 of remaining 51 are same color. $\frac{25}{51} \rightarrow C$

7. Only possible match is red shirt and shorts.

$$P(\text{Jim}) \times P(\text{Fred}) = \left(\frac{2}{9} \times \frac{1}{2}\right) \times \left(\frac{4}{17} \times \frac{4}{10}\right) = \frac{8}{765} \rightarrow B$$

8. # of ways if:

Mary on end: $2 \times 1 = 2$

Mary not on end: $6 \times 2 = 12$

14 total

$$\frac{14}{8 \times 7} = \frac{14}{56} = \frac{1}{4} \rightarrow C$$

9. $\frac{1}{4!} = \frac{1}{24} \rightarrow D$

10. $\left(\frac{2}{3}\right)^{10} = \frac{1024}{59049} \rightarrow A$

11. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29 → $\frac{10}{30} = \frac{1}{3} \rightarrow A$

Theta Probability Solutions 2

12. $\frac{1}{2}\times\frac{1}{8}+\frac{1}{2}\times\frac{6}{7}=\frac{55}{112}\rightarrow A$

13. $f(x)>0$ if $0<x<2$ $\quad\frac{2}{4}=\frac{1}{2}\rightarrow D$

14. Must be stopped at four of eight lights in any order.
$\binom{8}{4}\times\left(\frac{1}{3}\right)^4\times\left(\frac{2}{3}\right)^4=\frac{1120}{6561}\rightarrow C$

15. $\frac{\binom{7}{1}\times\binom{3}{1}}{\binom{10}{2}}=\frac{7}{15}\rightarrow B$

16. $\binom{10}{4}\times\left(\frac{1}{2}\right)^{10}=\frac{105}{512}\rightarrow B$

17. First toss can be any outcome, after that only one possible way to meet criteria. $\left(\frac{1}{2}\right)^8=\frac{1}{256}\rightarrow B$

18. $\frac{\text{Area of inner circle}}{\text{Area of board}}=\frac{2^2\pi}{100^2\pi}=\frac{1}{25}\rightarrow D$

19. $\frac{7}{9}\times\frac{6}{8}\times\frac{5}{7}\times\frac{4}{6}=\frac{5}{18}\rightarrow A$

20. $1-P(\text{two empties adjacent})=1-\frac{9}{\binom{10}{2}}=\frac{4}{5}\rightarrow C$

21. Each chip has $7/8$ probability of not being in chosen cookie
$\left(\frac{7}{8}\right)^{20}=.0642\rightarrow D$

Theta Probability Solutions

22. Can search 3 sq. mi. in 36 hours.

$\frac{3}{16\pi} \rightarrow D$

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23. $\frac{\sum_{n=10}^{15} \binom{15}{n}}{\sum_{n=0}^{15} \binom{15}{n}} = \frac{309}{2048} \rightarrow C$

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24. blue from A: $\frac{1}{2} \times \left[\frac{\binom{4}{2}}{\binom{11}{2}} + \frac{\binom{7}{2}}{\binom{11}{2}}\right] = \frac{27}{110}$

red from A: $\frac{1}{2} \times \left[\frac{\binom{3}{2}}{\binom{11}{2}} + \frac{\binom{8}{2}}{\binom{11}{2}}\right] = \frac{31}{110}$

$\frac{27}{110} + \frac{31}{110} = \frac{29}{55} \rightarrow A$

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25. $\frac{1}{\binom{18}{3}} = \frac{1}{816} \rightarrow B$

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26. $1 - P(\text{doesn't get answer}) = 1 - \left(\frac{1}{2}\right)^5 = \frac{31}{32} \rightarrow D$

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27. $f(x) < 2 \rightarrow 3x^2 < 2 \rightarrow x^2 < \frac{2}{3} \rightarrow x < \frac{\sqrt{6}}{3} \rightarrow \frac{\sqrt{6}/3}{3} = \frac{\sqrt{6}}{9} \rightarrow B$

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28. (# five card sequences) × (# suits) = 9×4 = 36 straight flushes possible

$\frac{36}{\binom{52}{5}} = 1.385 \times 10^{-5} \rightarrow C$

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29. $\binom{6}{3} = 20$ sets of 3 distinct numbers; each set can be placed in correct order one way.

$\frac{20}{6^3} = \frac{5}{54} \rightarrow A$

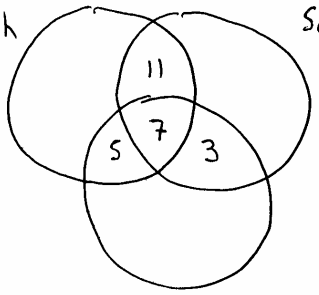
Theta Probability Solutions

30. P(Bob arrives between 1:30 and 3:45) × P(Jane's time overlaps) + P(Bob between 1:00 and 1:30) × P(overlap) + P(Bob 3:45 to 4:00) × P(overlap) =

$\left(\frac{3}{4}\right)\times\left(\frac{1}{4}\right)+\left(\frac{1}{6}\right)\times\left(\frac{1}{6}\right)+\left(\frac{1}{12}\right)\times\left(\frac{5}{24}\right)=\frac{67}{288}\rightarrow D$

31. Ignore extraneous information; each person equally likely to get "x". $\frac{1}{4}\rightarrow B$

32. English, Science, History



$18+12+10-2x=200-174$

$\downarrow$

$x=7$

$\frac{7}{200}\rightarrow A$

33. $\left(\frac{17}{18}\right)\times\left(\frac{13}{14}\right)=\frac{221}{252}\rightarrow B$

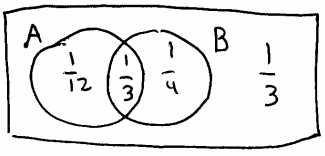
34. $1-P(S)=1-\frac{5^2}{5^2+1}=\frac{1}{26}\rightarrow B$

35. Qualifying numbers are squares of primes:

$2^2=4,\ 3^2=9,\ 5^2=25,\ 7^2=49,\ 11^2=121,\ 13^2=169,\ 17^2=289$ ← too big

$\frac{6}{200}=\frac{3}{100}\rightarrow D$

36.



$\frac{1}{3}\rightarrow D$

Theta Probability Solutions 5

37. $\frac{1}{12} + \frac{1}{3} = \frac{5}{12} \rightarrow C$

38. if A=5, probability is $\frac{1}{2}$; if A=10, probability is zero. probability varies linearly between these two values, so average:

$\frac{1}{2}\left(\frac{1}{2}+0\right) = \frac{1}{4} \rightarrow B$

39. $\frac{1}{3!} = \frac{1}{6} \rightarrow B$

40. $\frac{\binom{8}{3}\times\binom{8}{3}}{\binom{16}{8}} = \frac{1568}{6435} \rightarrow C$