Math 451 HW #1

Maxwell Levin

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Question 1

Toss a coin seven times. List all sample points of the event "a run of four or more heads". How many are there?

We denote the result of tossing the coin in the form $(d_1, d_2, d_3, d_4, d_5, d_6, d_7)$, where d_1 represents the results of the first toss, d_2 represents the second toss, and so on. For each d_i we say that $d_i = 1$ represents a result of heads and $d_i = 0$ represents a result of tails. We can then list all the possible ways of getting four or more heads in a row as:

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(0, 0, 0, 1, 1, 1, 1)   (0, 1, 1, 1, 1, 0, 1)   (1, 0, 1, 1, 1, 1, 1)   (1, 1, 1, 1, 0, 1, 1)
(0, 0, 1, 1, 1, 1, 0)   (0, 1, 1, 1, 1, 1, 0)   (1, 1, 0, 1, 1, 1, 1)   (1, 1, 1, 1, 1, 0, 0)
(0, 0, 1, 1, 1, 1, 1)   (0, 1, 1, 1, 1, 1, 1)   (1, 1, 1, 1, 0, 0, 0)   (1, 1, 1, 1, 1, 0, 1)
(0, 1, 0, 1, 1, 1, 1)   (1, 0, 0, 1, 1, 1, 1)   (1, 1, 1, 1, 0, 0, 1)   (1, 1, 1, 1, 1, 1, 0)
(0, 1, 1, 1, 1, 0, 0)   (1, 0, 1, 1, 1, 1, 0)   (1, 1, 1, 1, 0, 1, 0)   (1, 1, 1, 1, 1, 1, 1)
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Thus we see that there are 20 unique possible outcomes with 4 or more heads in a row.

Question 2.

Roll three dice. List all sample points of the event "the maximum is 3". How many are there?

We follow a similar format for our notation here. We let d_1, d_2, d_3 represent the result of rolling three dice. Here each d_i can take on a value from 1 to 6. Below we list all the possibilities of rolling three die so that the maximum is 3:

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(1, 1, 3)
(1, 2, 3)
(1, 3, 1)
(1, 3, 2)
(1, 3, 3)
(2, 1, 3)
(2, 2, 3)
(2, 3, 1)
(2, 3, 2)
(2, 3, 3)
(3, 1, 1)
(3, 1, 2)
(3, 1, 3)
(3, 2, 1)
(3, 2, 2)
(3, 2, 3)
(3, 3, 1)
(3, 3, 2)
(3, 3, 3)
```

We see that there are 19 such outcomes.