**STATISTICS ASSIGNMENT-3**

**Q1**. For a group of 7 people, find the probability that all 4 seasons (winter, spring, summer, fall)

occur at least once each among their birthdays, assuming that all seasons are equally likely.

**Answer:**

Let Ai be the event that there are no birthdays in the *i*th season. The probability that all seasons occur at least once is 1 P(A1 ꓴ A2 ꓴ A3 ꓴ A4). Note that A1 ∩ A2 ∩ A3 ∩ A4 = 0. Using the inclusion-exclusion principle and the symmetry of the seasons,

P(A1 ꓴ A2 ꓴ A3 ꓴ A4) = 4∑i=1P(Ai) - 3∑i=1 4∑j>i P(Ai ∩ Aj ) + 3∑i=1 ∑j>i ∑k>j P(Ai ∩ Aj ∩ Ak)

= 4P(A1) - 6P(A1 ∩ A2) + 4P(A1 ∩ A2 ∩ A3).

We have P(A1) = (3/4)7. Similarly,

P(A1 ∩ A2) = 1/27 and P(A1 ∩ A2 ∩ A3) = 1/47 .

Therefore, P(A1 ꓴ A2 ꓴ A3 ꓴ A4) = 4(3/4)7-6/27+ 4/47 . So the probability that all 4 seasons occur at least once is 1-(4( 3/4 )7-6/27+4/47 ≅ 0.513.

**Q2**. Alice attends a small college in which each class meets only once a week. She is deciding

between 30 non-overlapping classes. There are 6 classes to choose from for each day of the

week, Monday through Friday. Trusting in the benevolence of randomness, Alice decides to

register for 7 randomly selected classes out of the 30, with all choices equally likely. What is

the probability that she will have classes every day, Monday through Friday?

**Answer:**



