17) Hi this is Asmita! I am a Student Success Coach and will be explaining some practice problems from the MA121 Introduction to Statistics course. Today we will review an assigned problem from Unit 2. In the “Homework Assessment” you were asked to solve this problem:

The sample space that describes all three-child families according to the genders of the children with respect to birth order was constructed in Note 3.9 "Example 4". Identify the outcomes that comprise each of the following events in the experiment of selecting a three-child family at random.

- a. At least one child is a girl.
- b. At most one child is a girl.
- c. All of the children are girls.
- d. Exactly two of the children are girls.
- e. The first born is a girl.

The approach for this problem is as follows:

1. Define an event
2. List out all appropriate outcomes from the sample space, which are required for the given events by referring Note 3.9 “Example 4.”
3. Write down the outcomes in set notation.

By referring the Note 3.9 “Example 4,” the sample space is

\[ S = \{ \text{bbb, bbg, bgb, bgg, gbb, gbg, ggb, ggg} \} \]

a. **Step 1:** Define an event:

Define A: At least one child is a girl.

At least one child is a girl means there are one or more girls in a family, that is, select an outcome, which contains one girl or two girls or three girls.

**Step 2:** Write all outcomes for at least one child is a girl:

The outcomes \text{bbg, bgb, gbb} denote that the family has one girl. The outcomes \text{bgg, gbg, ggb} denote that the family has two girls. And the outcome \text{ggg} denotes that the family has three girls.

Therefore, the total outcomes for the event A “at least one child is a girl” are bbg, bgb, gbb, bgg, gbg, ggb, ggg.
Step 3: Write in set notation:

Therefore, the outcomes for the event A are \{bbg, bgb, bgg, gbg, ggb, ggg\}.

b.

Step 1: Define an event:

Define B: At most one child is a girl, which means there is no more than one girl in a family. Hence the family can contain either no girl or one girl.

Step 2: Write all outcomes for at most one child is a girl:

The outcome bbb denotes the family has three boys, which means there is no girl. Also, the outcomes bb, bg, gbb denote that the family has one girl.

Therefore, the total outcomes for the event B, that is, for “at most one child is a girl” are bbb, bb, bg, gbb.

Step 3: Write in set notation:

Therefore, the outcomes for the event B are \{bbb, bb, bg, gbb\}.

c.

Step 1: Define an event:

Define C: All of the children are girls, which means the family has three girls.

Step 2: Write all outcomes for all of the children are girls:

The outcome ggg denotes that the family has three girls.

Step 3: Write in set notation:

Therefore, the outcome for the event C is \{ggg\}.
d.

**Step 1:** Define an event:

Define D: Exactly two of the children are girls, which means the family contains two girls and one boy.

**Step 2:** Write the all outcomes for exactly two of the children are girls:

The outcome **bgg, gbg, ggb** denote that the family has exactly two girls and one boy.

**Step 3:** Write in set notation:

Therefore, the outcome for the event D is \{bgg, gbg, ggb\}.

e.

**Step 1:** Define an event:

Define: The first born is a girl.

That means the family contains the first child as girl and remaining two are either boy or girl.

**Step 2:** Write the all outcomes for the first born is a girl:

The outcomes **gbb, gbg, ggb, ggg** denote that the family has first child as girl.

**Step 3:** Write in set notation:

Therefore, the outcome for the event E is \{gbb, gbg, ggb, ggg\}.

**Conclusion:**

The outcomes for each event are as follows:

a. \{bbg, bgb, bgg, gbb, gbg, ggb, ggg\}
b. \{bbb, bb, bbg, gbb\}
c. \{ggg\}
d. \{bgg, gbg, ggb\}
e. \{gbb, gbg, ggb, ggg\}
Please let me know if you have any question on this problem, or on this topic generally. I will be here in the forum for the next hour.