# EJERCICIOS PROBABILIDAD

**SAMPLE SPACES AND EVENTS**

Provide a reasonable description of the sample space for each of the following random experiments.

1. Each of three machined parts is classified as either above or below the target specification for the part. R/8

2. A scale that displays two decimal places is used to measure material feeds in a chemical plant in tons. R/10

3. Calls are repeatedly placed to a busy phone line until a connect is achieved.

**PROBABILIDAD**

4. Una lista de reproducción de iPod contiene 100 canciones, de las cuales 10 son de los Beatles. Supongamos que la función de reproducción aleatoria se utiliza para reproducir las canciones en orden aleatorio. ¿Cuál es la probabilidad de que la primera canción de los Beatles escuchada sea la quinta canción reproducida?

5. El almacén de una universidad recibió 25 impresoras, de las cuales 10 son impresoras láser y 15 son modelos de inyección de tinta. Si 6 de estas 25 se seleccionan al azar para que las revise un técnico particular, ¿cuál es la probabilidad de que exactamente 3 de las seleccionadas sean impresoras láser (de modo que las otras 3 sean de inyección de tinta)?

6. Con fecha de abril de 2006, aproximadamente 50 millones de nombres de dominio web.com fueron registrados (p. ej., yahoo.com).

   a. ¿Cuántos nombres de dominio compuestos de exactamente dos letras en sucesión pueden ser formados? ¿Cuántos nombres de dominio de dos letras existen si como caracteres se permiten dígitos y letras?

   b. ¿Cuántos nombres de dominio existen compuestos de tres letras en secuencia? ¿Cuántos de esta longitud existen si se permiten letras o dígitos?

   c. Responda las preguntas hechas en (b) para secuencias de cuatro caracteres.

   d. Con fecha de abril de 2006, 97786 de las secuencias de cuatro caracteres utilizando o letras o dígitos aún no habían sido reclamadas. Si se elige un nombre de cuatro caracteres al azar, ¿cuál es la probabilidad de que ya tenga dueño?

7. Beethoven escribió 9 sinfonías y Mozart 27 conciertos para piano.

    a. Si el locutor de una estación de radio de una universidad desea transmitir primero una sinfonía de Beethoven y luego un concierto de Mozart, ¿de cuántas maneras puede hacerlo?

    b. El gerente de la estación decide que en cada noche sucesiva (7 días a la semana), se tocará una sinfonía de Beethoven, seguida por un concierto para piano de Mozart, seguido por un cuarteto de cuerdas de Schubert (de los cuales existen 15). ¿Durante aproximadamente cuántos años se podría continuar con esta política antes de que exactamente el mismo programa se repitiera?

8. Una empresa de producción emplea 20 trabajadores en el turno de día, 15 en el turno de tarde y 10 en el turno de medianoche. Un consultor de control de calidad va a seleccionar 6 de estos trabajadores para entrevistas a fondo. Suponga que la selección se hace de tal modo que cualquier grupo particular de 6 trabajadores tiene la misma oportunidad de ser seleccionado al igual que cualquier otro grupo (sacando 6 papelitos de entre 45 sin reemplazarlos).

    a. ¿Cuántas selecciones resultarán en que los 6 trabajadores seleccionados provengan del turno de día? ¿Cuál es la probabilidad de que los 6 trabajadores seleccionados sean del turno de día?

    b. ¿Cuál es la probabilidad de que los 6 trabajadores seleccionados sean del mismo turno? c. ¿Cuál es la probabilidad de que por lo menos dos turnos diferentes estén representados entre los trabajadores seleccionados?

    c. ¿Cuál es la probabilidad de que por lo menos uno de los turnos no esté representado en la muestra de trabajadores?

9. Un experimentador está estudiando los efectos de la temperatura, la presión y el tipo de catalizador en la producción de cierta reacción química. Tres diferentes temperaturas, cuatro presiones distintas y cinco catalizadores diferentes se están considerando.

    a. Si cualquier experimento particular implica utilizar una temperatura, una presión y un catalizador, ¿cuántos experimentos son posibles?

    b. ¿Cuántos experimentos existen que impliquen el uso de la temperatura más baja y dos presiones bajas?

    c. Suponga que se tienen que realizar cinco experimentos diferentes el primer día de experimentación. Si los cinco se eligen al azar de entre todas las posibilidades, de modo que cualquier grupo de cinco tenga la misma probabilidad de selección, ¿cuál es la probabilidad de que se utilice un catalizador diferente en cada experimento?

**2-21.** A digital scale is used that provides weights to the nearest gram.

(a) What is the sample space for this experiment?

Let $A$ denote the event that a weight exceeds 11 grams, let $B$ denote the event that a weight is less than or equal to 15 grams, and let $C$ denote the event that a weight is greater than or equal to 8 grams and less than 12 grams.

Describe the following events.

(b) $A \cup B$ (c) $A \cap B$

(d) $A'$ (e) $A \cup B \cup C$

**2-35.** The sample space of a random experiment is $\{a, b, c, d, e\}$ with probabilities 0.1, 0.1, 0.2, 0.4, and 0.2, respectively. Let $A$ denote the event $\{a, b, c\}$, and let $B$ denote the event $\{c, d, e\}$. Determine the following:

(a) $P(A)$ (b) $P(B)$

(c) $P(A')$ (d) $P(A \cup B)$

(e) $P(A \cap B)$

**2-37.** An injection-molded part is equally likely to be obtained from any one of the eight cavities on a mold.

(a) What is the sample space?

(b) What is the probability a part is from cavity 1 or 2?

(c) What is the probability that a part is neither from cavity 3 nor 4?

**2-39.** Orders for a computer are summarized by the optional features that are requested as follows:

| | proportion of orders |
|---|---|
| no optional features | 0.3 |
| one optional feature | 0.5 |
| more than one optional feature | 0.2 |

(a) What is the probability that an order requests at least one optional feature?

(b) What is the probability that an order does not request more than one optional feature?

**2-41.** A sample preparation for a chemical measurement is completed correctly by 25% of the lab technicians, completed with a minor error by 70%, and completed with a major error by 5%.

(a) If a technician is selected randomly to complete the preparation, what is the probability it is completed without error?

(b) What is the probability that it is completed with either a minor or a major error?

**2-43.** Suppose your vehicle is licensed in a state that issues license plates that consist of three digits (between 0 and 9) followed by three letters (between $A$ and $Z$). If a license number is selected randomly, what is the probability that yours is the one selected?

**2-47.** Samples of emissions from three suppliers are classified for conformance to air-quality specifications. The results from 100 samples are summarized as follows:

| | | conforms | |
|---|---|---|---|
| | | yes | no |
| supplier | 1 | 22 | 8 |
| | 2 | 25 | 5 |
| | 3 | 30 | 10 |

Let $A$ denote the event that a sample is from supplier 1, and let $B$ denote the event that a sample conforms to specifications. If a sample is selected at random, determine the following probabilities:

(a) $P(A)$ (b) $P(B)$

(c) $P(A')$ (d) $P(A \cap B)$

(e) $P(A \cup B)$ (f) $P(A' \cup B)$

**2-49.** If $P(A) = 0.3$, $P(B) = 0.2$, and $P(A \cap B) = 0.1$, determine the following probabilities:

(a) $P(A')$ (b) $P(A \cup B)$

(c) $P(A' \cap B)$ (d) $P(A \cap B')$

(e) $P[(A \cup B)']$ (f) $P(A' \cup B)$

**2-55.** A manufacturer of front lights for automobiles tests lamps under a high humidity, high temperature environment using intensity and useful life as the responses of interest. The following table shows the performance of 130 lamps:

| | | useful life | |
|---|---|---|---|
| | | satisfactory | unsatisfactory |
| intensity | satisfactory | 117 | 3 |
| | unsatisfactory | 8 | 2 |

(a) Find the probability that a randomly selected lamp will yield unsatisfactory results under any criteria.

(b) The customers for these lamps demand 95% satisfactory results. Can the lamp manufacturer meet this demand?

**2-61.** Consider the data on wafer contamination and location in the sputtering tool shown in Table 2-2. Assume that one wafer is selected at random from this set. Let $A$ denote the event that a wafer contains four or more particles, and let $B$ denote the event that a wafer is from the center of the sputtering tool. Determine:

(a) $P(A)$ (b) $P(A|B)$
(c) $P(B)$ (d) $P(B|A)$
(e) $P(A \cap B)$ (f) $P(A \cup B)$

**Table 2-2** Wafers Classified by Contamination and Location

| Number of Contamination Particles | Center | Edge | Totals |
|---|---|---|---|
| 0 | 0.30 | 0.10 | 0.40 |
| 1 | 0.15 | 0.05 | 0.20 |
| 2 | 0.10 | 0.05 | 0.15 |
| 3 | 0.06 | 0.04 | 0.10 |
| 4 | 0.04 | 0.01 | 0.05 |
| 5 or more | 0.07 | 0.03 | 0.10 |
| Totals | 0.72 | 0.28 | 1.00 |

**2-67.** A maintenance firm has gathered the following information regarding the failure mechanisms for air conditioning systems:

| | | evidence of gas leaks | |
|---|---|---|---|
| | | yes | no |
| evidence of electrical failure | yes | 55 | 17 |
| | no | 32 | 3 |

The units without evidence of gas leaks or electrical failure showed other types of failure. If this is a representative sample of AC failure, find the probability

(a) That failure involves a gas leak
(b) That there is evidence of electrical failure given that there was a gas leak
(c) That there is evidence of a gas leak given that there is evidence of electrical failure

**2-73.** Suppose 2% of cotton fabric rolls and 3% of nylon fabric rolls contain flaws. Of the rolls used by a manufacturer, 70% are cotton and 30% are nylon. What is the probability that a randomly selected roll used by the manufacturer contains flaws?

**2-79.** A batch of 25 injection-molded parts contains 5 that have suffered excessive shrinkage.

(a) If two parts are selected at random, and without replacement, what is the probability that the second part selected is one with excessive shrinkage?
(b) If three parts are selected at random, and without replacement, what is the probability that the third part selected is one with excessive shrinkage?

**2-82.** If $P(A|B) = 0.3$, $P(B) = 0.8$, and $P(A) = 0.3$, are the events $B$ and the complement of $A$ independent?

**2-87.** The probability that a lab specimen contains high levels of contamination is 0.10. Five samples are checked, and the samples are independent.

(a) What is the probability that none contains high levels of contamination?
(b) What is the probability that exactly one contains high levels of contamination?
(c) What is the probability that at least one contains high levels of contamination?

**2-95.** Software to detect fraud in consumer phone cards tracks the number of metropolitan areas where calls originate each day. It is found that 1% of the legitimate users originate calls from two or more metropolitan areas in a single day. However, 30% of fraudulent users originate calls from two or more metropolitan areas in a single day. The proportion of fraudulent users is 0.01%. If the same user originates calls from two or more metropolitan areas in a single day, what is the probability that the user is fraudulent?

**2-98.** An inspector working for a manufacturing company has a 99% chance of correctly identifying defective items and a 0.5% chance of incorrectly classifying a good item as defective. The company has evidence that its line produces 0.9% of nonconforming items.

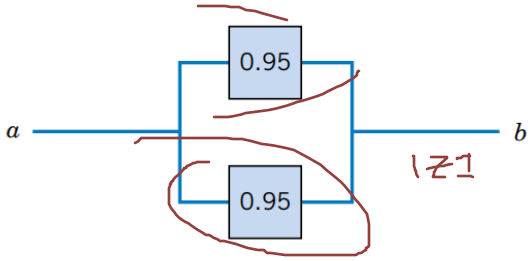
(a) What is the probability that an item selected for inspection is classified as defective?
(b) If an item selected at random is classified as nondefective, what is the probability that it is indeed good?

**Ejercicio 1**

The following circuit operates only if there is a path of functional devices from left to right. The probability that each device functions is shown on the graph. Assume that devices fail independently. What is the probability that the circuit operates?


**Ejercicio 2**

The following circuit operates only if there is a path of functional devices from left to right. The probability that each device functions is shown on the graph. Assume that devices fail independently. What is the probability that the circuit operates?




**Ejercicio 3**

The following circuit operates only if there is a path of functional devices from left to right. The probability that each device functions is shown on the graph. Assume that devices fail independently. What is the probability that the circuit operates?