ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

Statistics for Business **Fall Semester 2026–2027**

Assignment 1

(Release Date: 01/09/2026)

Answer the following questions and hand in your answers by **Monday, September 07, 2026**. These should **handwritten**, scanned and sent electronically (via E-mail at pkonstantinou.aueb@gmail.com). Please make sure that your files are in PDF format and that they do not exceed 8MB in size, otherwise the server might block them!

Calculating Probabilities

1. A logistics company offers 4 vessel types, 3 insurance packages, and 5 possible destination regions for a new shipping contract.

   (a) How many different contract configurations are possible if one option must be selected from each category?

   (b) If one of the destination regions is unavailable, how many configurations remain?

2. An examination in *Statistics for Business* contains 10 questions, 6 of which are on probability and 4 of which are on random variables. A student must answer 5 questions in the final exam.

   (a) How many different sets of 5 questions can be chosen?

   (b) How many selections contain exactly 3 probability questions and 2 random-variable questions?

   (c) If a set of 5 questions is chosen at random, what is the probability that it contains exactly 3 probability questions?

3. A shipping firm must rank 4 ports out of 7 possible ports (A, B, C, D, E, F, G) in order of priority.

   (a) How many rankings are possible?

   (b) How many rankings are possible if Port A must appear first?

4. For a randomly selected company,

$$A = \{\text{the company exports}\}, \qquad B = \{\text{the company imports intermediate inputs}\}.$$

Suppose

$$\Pr(A) = 0.48, \qquad \Pr(B) = 0.55, \qquad \Pr(A \cap B) = 0.30.$$

Calculate:

(a) $\Pr(A \cup B)$;

(b) the probability that the firm does neither;

(c) the probability that it exports but does not import intermediate inputs;

(d) the probability that it imports intermediate inputs but does not export.

5. The automobile industry sold 657,000 vehicles in the United States during January 2009. This volume was down 37% from January 2008 as economic conditions continued to decline. The Big Three U.S. automakers – General Motors, Ford, and Chrysler – sold 280,500 vehicles, down 48% from January 2008. A summary of sales by automobile manufacturer and type of vehicle sold is shown in the following table. Data are in thousands of vehicles. The non-U.S. manufacturers are led by Toyota, Honda, and Nissan. Thee category Light Truck includes pickup, minivan, SUV, and crossover models.

	Type	of Vehicle
	Car	Light Truck
U.S.	87.4	193.1
Non U.S.	228.5	148.0

(a) Develop a joint probability table for these data and use the table to answer the following questions.

(b) What are the marginal probabilities? What do they tell you about the probabilities associated with the manufacturer and the type of vehicle sold?

(c) If a vehicle was manufactured by one of the U.S. automakers, what is the probability that the vehicle was a car? What is the probability that it was a light truck?

(d) If a vehicle was not manufactured by one of the U.S. automakers, what is the probability that the vehicle was a car? What is the probability that it was a light truck?

(e) If the vehicle was a light truck, what is the probability that it was manufactured by one of the U.S. automakers?

(f) What does the probability information tell you about sales?

6. A survey of MSc students, provided the following data for 2018 students.

	Applied to More than One School	
Age Group	YES	NO
23 and under	207	201
24 – 26	299	379
27 – 30	185	268
31 – 35	66	193
36 and over	51	169

Table 1: Table: Survey Data

(a) For a randomly selected MSc student, prepare a joint probability table for the experiment consisting of observing the student's age and whether the student applied to one or more schools.

(b) What is the probability that a randomly selected applicant is 23 or under?

(c) What is the probability that a randomly selected applicant is older than 26?

(d) What is the probability that a randomly selected applicant applied to more than one school?

(e) Given that a person applied to more than one school, what is the probability that the person is 24–26 years old?

(f) Given that a person is in the 36-and-over age group, what is the probability that the person applied to more than one school?

(g) What is the probability that a person is 24–26 years old or applied to more than one school?

(h) Suppose a person is known to have applied to only one school. What is the probability that the person is 31 or more years old?

(i) Is the number of schools applied to independent of age? Explain.

7. Among customers of a bank, 45% use online banking, 30% use mobile banking, and 20% use both.

   (a) Find the probability that a customer uses mobile banking given that the customer uses online banking.

   (b) Find the probability that a customer uses online banking given that the customer uses mobile banking.

8. A freight company reports that 35% of its shipments are international. Among international shipments, 12% are delayed.

(a) Find the probability that a randomly selected shipment is both international and delayed.

(b) If 8% of domestic shipments are delayed, find the overall probability that a shipment is delayed.

Discrete Random Variables

9. Let X denote the number of insurance claims received by a small firm in a day, with probability distribution

x	0	1	2	3	4
$\Pr(X = x)$	0.15	0.30	0.30	0.20	0.05

   (a) Verify that this is a valid probability distribution.

   (b) Find $\Pr(X \leq 2)$.

   (c) Find $\Pr(X > 2)$.

   (d) Find $\Pr(1 \leq X \leq 3)$.

10. For the distribution in Exercise 9, calculate:

   (a) $E(X)$;

   (b) $E(X^2)$;

   (c) $Var(X)$;

   (d) the standard deviation of X.

11. Suppose

$$E(X) = 25, \qquad Var(X) = 9.$$

   Define

$$Y = 10 + 4X.$$

   Find:

   (a) $E(Y)$;

   (b) $Var(Y)$;

   (c) $sigma_Y$.

12. A company has probability 0.60 of winning a single tender. Let

$$X = \begin{cases} 1, & \text{if the tender is won,} \\ 0, & \text{otherwise.} \end{cases}$$

(a) Write the probability distribution of X.

(b) Find $E(X)$.

(c) Find $Var(X)$.

(d) Find the standard deviation.

13. A manufacturer knows that 8% of its products are defective. Suppose 6 items are independently selected. Let X denote the number of defective items.

(a) State the distribution of X.

(b) Find $\Pr(X = 1)$.

(c) Find $\Pr(X = 0)$.

(d) Find $\Pr(X \geq 1)$.

14. A bank contacts 10 customers. Each customer independently accepts a new product with probability 0.25. Let X be the number of acceptances.

(a) Find $\Pr(X = 2)$.

(b) Find $\Pr(X \leq 2)$.

(c) Find $E(X)$.

(d) Find $Var(X)$ and σ_X.

Continuous Random Variables

15. Using "TABLE 3 Areas under the Normal Curve" (Appendix I Tables) find the following probabilities for a standard normal random variable Z:

(a) $\Pr(0 \leq Z \leq 0.83)$

(b) $\Pr(-1.57 \leq Z \leq 0)$

(c) $\Pr(Z \geq 0.44)$

(d) $\Pr(Z \geq -0.23)$

(e) $\Pr(Z \leq 1.20)$

(f) $\Pr(Z \leq -0.71)$

(g) $\Pr(-1.98 \le Z \le 0.49)$

(h) $\Pr(0.52 \le Z \le 1.22)$

(i) $\Pr(-1.75 \le Z \le -1.04)$

16. Suppose monthly demand for a product is normally distributed:

$$X \sim N(500, 80^2).$$

Calculate:

(a) $\Pr(X < 620)$;

(b) $\Pr(X > 420)$;

(c) $\Pr(460 < X < 580)$.

17. A firm models monthly sales as

$$X \sim N(100, 15^2).$$

(a) Find the value $x_{0.10}$ such that

$$\Pr(X < x_{0.10}) = 0.10.$$

(b) Find the value $x_{0.95}$ such that

$$\Pr(X < x_{0.95}) = 0.95.$$

Multivariate Probability Distributions

18. The following table gives the joint distribution of firm size X and financing source Y:

	$Y = 0$	$Y = 1$	$Y = 2$	$\Pr(X = x)$
$X = 0$	0.18	0.12	0.10	0.40
$X = 1$	0.12	0.18	0.30	0.60
$\Pr(Y = y)$	0.30	0.30	0.40	1

(a) Find $\Pr(Y = 2)$.

(b) Find $\Pr(X = 1, Y = 1)$.

(c) Find $\Pr(Y = 2 \mid X = 1)$.

(d) Find $\Pr(X = 0 \mid Y = 0)$.

(e) Compute $E(Y \mid X = 0)$ and $E(Y \mid X = 1)$.

(f) Are X and Y statistically independent?

19. Suppose two random variables have

$$E(X) = 4, \qquad E(Y) = 7, \qquad E(XY) = 32,$$

and standard deviations

$$\sigma_X = 2, \qquad \sigma_Y = 3.$$

(a) Find $Cov(X, Y)$.

(b) Find $Corr(X, Y)$.

(c) Interpret the sign and approximate magnitude of the correlation.

20. Two investment funds have

$$\mu_X = 6, \qquad \sigma_X = 5,$$

$$\mu_Y = 10, \qquad \sigma_Y = 12,$$

and

$$Corr(X, Y) = 0.30.$$

A portfolio invests 30% in X and 70% in Y:

$$P = 0.3X + 0.7Y.$$

(a) Find $E(P)$.

(b) Find $Cov(X, Y)$.

(c) Find $Var(P)$.

(d) Find σ_P.

(e) Briefly explain why the covariance term enters the portfolio variance.