



Form B

FINAL. Exam
Academic Year 1446 Hijri.- FIRST. Semester

Exam Information معلومات الامتحان		
Course name	الاحتمالات والإحصاء الهندسي والاحتمالات والإحصاء للمهندسين	
Course Code	STAT 301& STAT 305	
Exam Date	24/12/26	تاريخ الامتحان
Exam Time		وقت الامتحان
Exam Duration	Two Hours	مدة الامتحان ساعتين
Classroom No.		رقم قاعة الاختبار
Instructor Name		اسم استاذ المقرر

Student Information معلومات الطالب		
Student's Name		اسم الطالب
ID number		الرقم الجامعي
Section No.		رقم الشعبة
Serial Number		الرقم التسلسلي

General Instructions:

- Your Exam consists of **7 PAGES**
- You are **NOT** allowed to use any form of notes, textbooks, or electronic devices (such as mobile phones or tablets) during the exam
- **Normal Calculators are allowed.**
- Please read each question carefully and answer all parts as instructed.

- عدد صفحات الامتحان 7 صفحات
- يمنع استخدام أي نوع من الملاحظات أو الكتب أو الأجهزة الإلكترونية (مثل الهواتف المحمولة أو الأجهزة اللوحية و الساعات الذكية) خلال الامتحان
- يسمح باستخدام الآلة الحاسبة العادية فقط
- يرجى قراءة كل سؤال بعناية والإجابة على جميع الأجزاء كما هو موضح

مع تمنياتنا لكم بالتوفيق

Good Luck

هذا الجزء خاص بأستاذ المادة

This section is ONLY for instructor

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
CLO01	Present data in charts and tables	Part1	4	
CLO02	Compute measures of location and measures of variability	Part2	4	
CLO03	Acquire basic concepts of probability theory	Part3	4	
CLO04	Distinguish between discrete, continuous random variables and probability distributions	Part4	4	
CLO05	Describe basic concepts of inferential statistics such as sampling distribution of means, the Central Limit Theorem	Part 5	4	
CLO06	Analyze measures of location and measures of variability	Part 6	2	
CLO07	Find the properties of probability distributions.	Part 7	4	
CLO08	Compute probability models for a given problem.	Part 8	6	
CLO09	Implement probability methods to solve real-world problems.	Part 9	6	
CLO10	Apply basic concepts of inferential statistics.	Part 10	2	
Total			40	

Part 1: CLO1

...../4 MARKS

Q1: You are given the following set of data points: 12,22,18,9,25,31,28,19,22,27,32,14

Based on that, answer the following question:

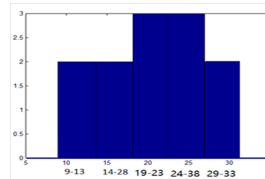
(3 marks)

- 1- Draw the grouped frequency table of the following data with 5 classes
- 2- Use histogram to represent the grouped frequency table

(show all steps)

$$\frac{32 - 9}{5} = \frac{\text{range}}{\# \text{ classes}} = \frac{23}{5} = 4.6$$

Class	Frequency
9 – 13	2
14 – 18	2
19 – 23	3
24 – 28	3
29 – 33	2



Q2: Draw frequency table for the.

(1 Mark)

1 2 6 7 2 6 5 7 1 5 5 6 5 5 2

We will count how many times each number appears and create the table:

Value	Frequency
1	2
2	3
5	5
6	3
7	2

Part 2: CLO 2

...../4 MARKS

Q1: Fatima received the following marks on her first 5 math tests: 72, 86, 92, 63, and 77. What score must Fatima earn on her **sixth** test to achieve an average of 80 across all **six** quizzesA. 75 B. 80 C. 85 **D. 90**Q2: The sales figures for the first six months of the year at a retail store are as follows (in dollars): 2200, 2500, 2300, 2400, 2200, and 2600. What is the **range** of the sales figures?A. 200 **B. 400** C. 500 D. 600Q3: What is the **quartiles** (Q1,Q3) of the following data score: 13, 26, 15,5,23,7,14,38,53,30,42A. 13,23 B. 14,38 C. 7, 23 **D. 13, 38**Q4: What is the **variance** marks of the following set which represents the degrees of STAT class students: 62 61 59 58 60 (Show Details)A. 1.5 B. 2 **C. 2.5** D. 3**Part 3: CLO 3**

...../4 MARKS

Q1 If you roll two dice, what is the probability of getting a sum of 7?

A. 1/36 B. 1/12 **C. 1/6** D. 1/3

Q2: If two events are mutually exclusive, what is the probability of both events occurring simultaneously?

A. 0 B. 1 C. 0.5 D. it depends on events

Q3: A bag contains 5 red balls and 3 blue balls. What is the probability of randomly picking a red ball?

A. 1/5 **B. 5/8** C. 3/5 D. 3/8Q4: A university is awarding **three** scholarships: "Academic Excellence", "Leadership", and "Community Service". These scholarships will be given to a group of 8 students, with each student receiving at most

one scholarship. How many different ways can the scholarships be assigned to the students?			
A. 336	B. 672	C. 504	D. 144
Q5: A nurse records whether patients show a certain symptom (S) or not (NS) during screening. Assume S or NS are equally likely for each new patient. If the sample space $S = \{S, NS\}$ and each outcome is equally likely, the probability of observing the symptom (S) for a new patient is:			
A. 0	B. 0.5	C. 0.33	D. 1
Q6: The probability of an event must always be:			
A. Greater than 1	B. Between 0 and 1 (inclusive)	C. Negative if the event is rare	D. Exactly equal to 0.5
Q7: If events A and B are mutually exclusive, then:			
A. $P(A \cup B) = P(A) + P(B)$	B. $P(A \cup B) = P(A) \times P(B)$	C. $P(A \cup B) < 0$	D. $P(A \cup B) = P(A) - P(B)$
Q8: If $P(A)=0.4$ and $P(B)=0.5$ and A and B are independent, then $P(A \cap B) =$			
A. 0.9	B. 0.45	C. 0.2	D. 0.5

Part 4: CLO4

...../4 MARKS

Q1 : A probability distribution must satisfy which of the following?	
A. All probabilities are greater than 1	C. The sum of probabilities is less than 1.
B. Probabilities can be negative.	D. Each probability is between 0 and 1, and the sum equals 1.
Q2: A random variable X follows a binomial distribution with parameters $n = 10$ and $p = 0.5$. What is the probability of getting exactly 3 successes?	
A. 0.1170	C. 0.3020
B. 0.2500	D. .0.5000
Q3: Which of the following is an example of a continuous random variable?	
A. The number of phone calls in an hour	C. The number of defective syringes in a batch.
B. The weight of a newborn baby (in kg.).	C. The count of patients in a waiting room
Q4. Which of the following is not type of Discrete Probability Distributions	
A. The Binomial Distribution	C. Bernoulli Distribution
B. Poisson Distribution	D. Normal Distribution
Q5. In a binomial distribution, what does the parameter 'n' represent?	
A. The probability of success	C. The number of successes
B. The probability of failure	D. The number of trials
Q6. representing the number of successes occurring in a given time interval or a specified region of space	
A. Poisson distribution	C. Continuou Uniform Distribution
B. Binomial Distribution	D. Normal Distribution
Q7. In Binomial Distribution the expected value (or mean) is equal to	
A. μ	C. $np(1-q)$
B. np	d. None of the above.
Q8. $Z \sim N(0,1)$ is called	
A. Normal distribution	C. Continuou Uniform Distribution
B. Standard normal distribution	D. Area under the curve.

Part 5: CLO5

...../4 MARKS

Q1:

(2 Marks)

Q1: In the context of inferential statistics, what does the term "standard error" refer to?	
A. The standard deviation of a sample	C. The difference between the sample mean and population mean
B. The error margin in a confidence interval	D. The standard deviation of the sampling

	distribution of the sample mean
Q2 If a sample of size 100 is drawn from a population with a mean of 50 and a standard deviation of 10, what is the <i>standard error</i> of the sample mean?	
A. 1	C. 0.5
B. 5	C. 10
Q3. A university publicizes: Proportion of students who graduate in 4 years is 82%., what is Null hypothesis	
A. $H_0:p=0.82$	C. $H_0:p\neq 0.82$
B. $H_0:p\geq 0.82$	D. $H_0:p\leq 0.82$
Q4. We reject the null hypothesis when the null is true this is called:	
A. Type 1 Error	C. Type 3 Error
B. Type 2 Error	D. Correct descion

Q2: A medical researcher is evaluating the effectiveness of a new rehabilitation program designed to shorten patient recovery times after knee surgery. She takes a random sample of $n = 64$ patients who completed the program and finds that the sample mean recovery time is $\bar{X} = 15$ days. Assume the population **standard deviation** (σ) is known to be 4 days. Using a **95% confidence level** (with $Z_{\alpha/2} = 1.96$), what is the interval best represents the 95% confidence interval for the population mean recovery time? **(2 Marks)**

Given:

Mean ($\bar{X}$) = 15 days

Standard deviation (σ) = 4 days

$n=64$

$Z_{\alpha/2} = 1.96$

$$\text{standard error} = \frac{\sigma}{\sqrt{n}} = \frac{4}{\sqrt{64}} = \frac{4}{8} = 0.5$$

$$UCL = \bar{x} + Z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \rightarrow \text{upper limit} \quad UCL = 15 + (0.5 * 1.96) = 15.98$$

$$LCL = \bar{x} - Z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \rightarrow \text{lower limit} \quad LCL = 15 - (0.5 * 1.96) = 14.02$$

Part 6: CLO6

.....\ 2 MARKS

Q1: Consider the following dataset representing the ages (in years) of 6 people:

25, 30, 27, 32, 28, 35.

- Task: Calculate the range, the median, variance, and standard deviation of this dataset

$$\text{Range} = \text{Max} - \text{min} = 35 - 25 = 10$$

$$\text{Median} = 25, 27, 28, 30, 32, 35$$

$$\text{Median} = \frac{28 + 30}{2} = \frac{58}{2} = 29$$

$$\bar{x} = \frac{25 + 30 + 27 + 32 + 28 + 35}{6} = \frac{177}{6} = 29.5$$

$$s^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$$

$$s = \sqrt{s^2} = \sqrt{13.1} \approx 3.62$$

Part 7: CLO7

$$s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1} = \frac{(25-29.5)^2 + (30-29.5)^2 + (27-29.5)^2 + (32-29.5)^2 + (28-29.5)^2 + (35-29.5)^2}{6-1} = 13.1$$

...../4 MARKS

Q1:

(2 marks)

Choose the correct answer

Q1 : The following formula $\mu = \sum_x x f(x) = \sum_{i=1}^k x_i \frac{1}{k} = \frac{1}{k} \sum_{i=1}^k x_i$ is used to compute?	
A. Mean of Binomial Distribution	C. Mean of Discrete Uniform Distribution
B. Mean of Poisson Distribution	D. Mean of Normal Distribution
Q2: What is the relationship between the mean (μ) and the variance of a Poisson distribution?	
A. The variance is always greater than the mean.	C. The variance is always equal to the mean.
B. The variance is always less than the mean.	D. There is no relationship between the mean and variance
Q3: Two variables and ... control the shape of the normal curve, suppose there are two distributions	
A. mean and standard deviation	C. standard deviation and variance
B. mean and variance	C. All of the above
Q4: In a continuous probability distribution, the probability of any single point is:	
A. 0	C. 0.5
B. 1	D. It depends on the question

Q2: An industrial quality control engineer is inspecting a batch of 10 identical machine parts produced in a manufacturing line. The probability that any single part is defective is $p = 0.05$. Assuming each part's condition is independent of the others. **(2 marks)**

(1) What is the probability that **no parts are defective** (i.e., $X = 0$)?

(a) Approximately 0.9139

(b) **Approximately 0.5987**

(c) Approximately 0.40123

(d) Approximately 0.9885

since $(100)=1\binom{10}{0}=1(010)=1$ and $(0.05)^0=1(0.05)^0=1(0.05)^0=1$, the formula simplifies to:

$$P(X=0)=(0.95)^{10} \quad P(X=0)=(0.95)^{10} \quad P(X=0)=(0.95)^{10}$$

(2) What is the **expected (mean)** number of defective parts in a batch of 10?

(a) 0.01

(b) 0.1

(c) 0.5

(d) 0.05

$$E(X)=10 \times 0.05 \quad E(X)=0.5 \quad E(X)=0.5 \quad E(X)=0.5$$

Part 8: CLO 8

...../6 MARKS

Q1: Suppose that a chips box has 25% of the bags are winner bags, the child's mom lets him select three bags of the box. The child want to know the probability of (x follow Binomial distribution): (2 marks)

- Getting no winner bags
- Probability of getting at least two winner bags.

Probability of success = $p = \frac{1}{4} = 0.25$

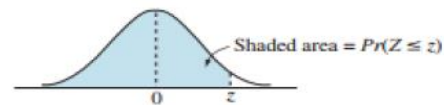
Probability of failure = $1 - p = 1 - \frac{1}{4} = \frac{3}{4} = 0.75$

(show all steps)

$$2 \quad p(x \geq 2) = P(x=2) + P(x=3) = \frac{9}{64} + \frac{1}{64} = \frac{10}{64}$$

Number of trials $n = 3$. Then $f(x) = b(x; 3, \frac{1}{4}) = \binom{3}{x} (\frac{1}{4})^x (\frac{3}{4})^{3-x} \quad x=0,1,2,3$

$$f(0) = b(0; 3, \frac{1}{4}) = \binom{3}{0} (\frac{1}{4})^0 (\frac{3}{4})^3 = \frac{27}{64}$$



Standard normal curve areas

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Q2: Using the standard normal table above ,find the area under the curve that lies:

(2 mark)

- $P(Z \geq -1.330)$

Answer:

$$P(Z \geq -1.33) = 1 - P(Z \leq -1.33)$$

$$P(Z \geq -1.33) = 1 - 0.0918 = 0.9082$$

- $P(-1.2 < Z < -0.2)$

Answer: $P(-1.2 < Z < -0.2) = P(Z \leq -0.2) - P(Z \leq -1.2)$

$P(Z \leq -1.2) \approx 0.1151$ and $P(Z \leq -0.2) \approx 0.4207$

Then: $P(-1.2 < Z < -0.2) = 0.4207 - 0.1151 = 0.3056$

Q3: An electronics company claims that the voltage output of their new battery model is **normally** distributed with a **mean** of 12 volts and a **standard deviation** of 0.2 volts. (2 mark)

(a) What is the probability that a randomly selected battery has a voltage **between 11.8 and 12.2 volts**?

$$Z = \frac{X - \mu}{\sigma}$$

For $X_1=11.18$

$$Z = \frac{11.8 - 12}{0.2} = \frac{-0.2}{0.2} = -1$$

For $X_2=12.2$

$$Z = \frac{12.2 - 12}{0.2} = \frac{0.2}{0.2} = 1$$

$$p(z=-1)=0.1587$$

$$p(z=1)=0.8413$$

$$P(11.8 \leq X \leq 12.2) = 0.8413 - 0.1587 = 0.6826$$

Q3:

Part 9: CLO9

$$P(D) = 0.034$$

.....\ 6 MARKS

Q1: The probability that a student attends a lecture is $P(A)=0.75$, the probability that the student completes the assignment is $P(C)=0.60$, and the probability that the student attends the lecture and completes the assignment is $P(A \cap C)=0.50$.

Find:

(1) The probability that a student completes the assignment given that they attended the lecture. (1 mark)

(You should show details answer)

$$P(C|A) = P(A \text{ intersection } C) / P(A) \\ = 0.50 / 0.75 = 0.6666$$

Q2: In a factory, machines M1, M2, and M3 produce 20%, 50%, and 30%, respectively, of the total products. The defect rates for each machine are as follows:

- Machine M1 has a defect rate of 2%.
- Machine M2 has a defect rate of 3%.
- Machine M3 has a defect rate of 5%.

What is the probability that a randomly selected product is defective? If it is defective what is the probability that it was made by machine M3? (2 mark)

(You should show details answer)

$$P(D) = P(D | M_1)P(M_1) + P(D | M_2)P(M_2) + P(D | M_3)P(M_3)$$

$$P(D) = (0.02)(0.2) + (0.03)(0.5) + (0.05)(0.3)$$

$$P(D) = 0.034$$

P (MADE BY M3)

$$P(M_3 | D) = \frac{(0.05)(0.3)}{0.034} = \frac{0.015}{0.034} = 0.441$$

Q3: A bus arrives every 10 minutes at a bus stop. It is assumed that the waiting time for a particular individual is a random variable with a continuous uniform distribution. (1 marks)

- (a) What is the probability density function of X?
- (b) What is the probability that the individual waits more than 6 minutes (at least 6 minutes)?

(show all steps)

$$a \quad f(x) = \begin{cases} \frac{1}{b-a}, & \text{if } a \leq x \leq b \\ 0, & \text{otherwise} \end{cases}$$

interval $[0, 10]$

$$f(x) = \begin{cases} \frac{1}{10-0} = 0.1, & \text{if } 0 \leq x \leq 10 \\ 0, & \text{otherwise} \end{cases}$$

b $P(X \geq 6) = 1 - (0.1 * (6-0)) = 0.4$

Q4: Suppose sales at a donut shop are distributed as below. Calculate (a) the mean number of donuts sold, (b) the variance (using both the definition of the variance & the theorem), & (c) the standard deviation. (2 marks)

x	p(x)	xp(x)	x-μ	(x-μ) ²	(x-μ) ² p(x)
94	0.25	23.5	-6	36	9
98	0.25	24.5	-2	4	1
102	0.25	25.5	2	4	1
106	0.25	26.5	6	36	9
		μ = 100			σ ² = 20

PART 10: CLO10:

...../2 MARKS

Q1: A Maximum error estimation is *the greatest possible distance between the point estimate and the value of the parameter it is estimating* and calculated by the Equation $E = Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$ (1 mark)

Q2: (1 mark)

Which statement best describes the **null hypothesis (H₀)** in a hypothesis test?

- (a) It asserts that there is a significant difference or effect.
- (b) *It represents the idea that any observed difference is due to random chance.*
- (c) It is always accepted as true without testing.
- (d) It must always be rejected in favor of the alternative hypothesis.