eman ta zabal zazu

Universidad del País Vasco   Euskal Herriko Unibertsitatea

DIRECTIONS

1. Correctly answered questions give one point. There is only one correct answer to each question. Questions not correctly answered carry a penalty of −0.20 points, so it is better to leave a question unanswered rather than giving a wrong answer.
2. Our goal is to gauge your understanding and command of concepts learned during the course, not your visual sharpness. It is a fact, though, that in a multiple choice exam great attention has to be paid to the details. It is quite common that knowledgeable students waste their chances of a good grade because they do not pay sufficient attention to the precise wording of questions.

Please, do yourself a favour and read carefully before you answer!

3. It will probably help you to discard first answers that are clearly inadequate.
4. Students scoring 10 points or better in this exam will earn a full 0.75 points of their final grade.
5. The time scheduled for this exam is 1h.

Do not turn the page until advised to do so!
Mark the type of your exam on the orange sheet NOW!!

Statistics Applied to Economics

First Quiz, March, 2, 2012, Exam version: $\boxed{1}$

Last name: ______________________

First name: ______________________

DNI: ______________________

Group: ______________________

Instructor: ______________________

Section 1. Multiple choice questions

START OF A QUESTION BLOCK

Questions up until the next horizontal line refer to

the same situation, described in the question next.

1. You visit Las Vegas, and enter one casino. There, you find two machines, both of them accepting bets of \$10. The prize in dollars you get for your bet is $\gamma(a = 1, r = 5)$ distributed in the first case and $\mathcal{P}(\lambda = 5)$ distributed in the second. What is the expected net return (prize - bet) if you play once?
   - (a) \$5
   - (b) \$7
   - (c) -\$3
   - (d) -\$7
   - (e) -\$5

2. Which of the two machines can more likely produce a prize in excess of \$10.25?
   - (a) The machine with $\gamma(a = 1, r = 5)$ prizes.
   - (b) The machine with $\mathcal{P}(\lambda = 5)$ prizes.
   - (c) Both machines produce such prizes with the same probability.
   - (d) No machine can produce such prize.
   - (e) Cannot tell.

END OF A QUESTION BLOCK

---

3. Invoking the central limit theorem, we can be confident that for large degrees of freedom n, the distribution χ^2_n will be fairly well approximated by:
   - (a) A $N(n, 2n)$ distribution.
   - (b) A $\gamma(n, 2n)$.
   - (c) It will be exactly a $\gamma(n, 2n)$; this has nothing to do with the central limit theorem.
   - (d) A normal, $N(a, \sigma^2 = r^2/a)$, where a and r are the parameters of the "mother" $\gamma(a, r)$.
   - (e) All other answers are false.

4. The Poisson distribution *could* be a good model for:
   - (a) Lengths of time between successive occurrences of an event, such as the collision of two planes in flight.
   - (b) The number of times something happens in a time interval of fixed length.
   - (c) Observed temperatures in Bilbao, when we measure in Celsius degrees.
   - (d) The difference of goals scored and received by a football team in a given season.
   - (e) All other answers are false.

5. The sum of independent variables with gamma distribution $\gamma(a, r)$ is again a gamma distribution, under certain conditions. Which of the following, if any, is true? (In the symbolic equalities below, the left hand side denotes the distribution of the sum, the terms in the right hand side the distributions of the variables added.)

   (a) $\gamma(a, r_1 + \ldots + r_n) = \gamma(a, r_1) + \ldots + \gamma(a, r_n)$

   (b) $\gamma(a_1 + \ldots + a_n, r) = \gamma(a_1, r) + \ldots + \gamma(a_n, r)$

   (c) $\gamma(a_1 + \ldots + a_n, r_1 + \ldots + r_n) = \gamma(a_1, r_1) + \ldots + \gamma(a_n, r_n)$

   (d) All other answers are false.

6. The parameter λ of a Poisson distribution $\mathcal{P}(\lambda)$ is:

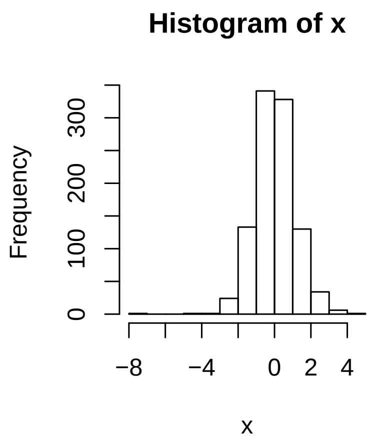
   (a) The mode of the distribution.

   (b) Always an integer number.

   (c) The mean and the variance of the distribution.

   (d) The mean and standard deviation of the distribution.

7. Look at the following histogram, of a random sample from an unknown distribution. Among the distributions listed next, only one could possible have produced such histogram.



   (a) $\mathcal{F}_{4,5}$

   (b) t_{10}

   (c) χ^2_5

   (d) Square-normal.

   (e) Poisson, $\mathcal{P}(\lambda = 3)$.

8. The form of the probability function for the Poisson $\mathcal{P}(\lambda)$ distribution is easy enough to allow you to compute Prob(X) when $X \sim \mathcal{P}(\lambda = 1.35)$ with only a pocket calculator. What is the approximate value of Prob$(X = 4)$ in that case?

   (a) 0.02322

   (b) 0.01223

   (c) 0.03588

   (d) 0.12934

9. Let $\mathcal{F}^{\alpha}_{m,n}$ be the value leaving a tail of probability α in an Snedecor's $\mathcal{F}$ distribution with m and n degrees of freedom. Which of the following is true?

   (a) $\mathcal{F}^{\alpha}_{m,n} = \mathcal{F}^{1-\alpha}_{n,m}$

   (b) $\mathcal{F}^{\alpha}_{m,n} = 1/\mathcal{F}^{1-\alpha}_{n,m}$

   (c) $\mathcal{F}^{\alpha}_{m,n} = 1 - \mathcal{F}^{\alpha}_{n,m}$

   (d) $\mathcal{F}^{\alpha}_{m,n} = 1/\mathcal{F}^{\alpha}_{n,m}$

   (e) All other answers are false.

10. Assuming $X \sim t_5$ and $Y \sim \chi^2_6$, mark the true inequality among the following:

   (a) Prob$(X > 4.54) > 0.03$

   (b) Prob$(Y > 16.8) > 0.03$

   (c) Prob$(Y > 16.8) <$ Prob$(X > 2.57)$

   (d) Prob$(Y > 10.6) > 0.95$

   (e) Prob$(X < 2.57) < 0.90$

11. For large n, a binomial distribution $B(p, n)$ can be closely approximated by a normal, provided that:

   (a) p is very small.

   (b) np very close to zero.

   (c) np is large enough.

   (d) $np < 18$.

12. If $X \sim t_6$, the it is clear that X^2 is distributed as:

   (a) χ^2_6

   (b) t_{36}

   (c) $(1/\sqrt{\chi^2_6/6})^2$.

   (d) $\mathcal{F}_{1,6}$

   (e) $\mathcal{F}_{6,1}$

13. Assume the number of people calling the 112 emergency number in one day is Poisson distributed. The average of daily calls in a week has been 80. What would be your best guess about the value of λ?

    (a) 80
    (b) 80^2
    (c) $\sqrt{80}$
    (d) All other answers are false.

14. The capital city of Spain is:

    (a) Paris.
    (b) Pekín.
    (c) Madrid.
    (d) Kuala Lumpur.

15. Which of the following distributions is obviously ***not*** a good candidate as a model for the distribution of prices at which stocks are traded?

    (a) Student's t_n.
    (b) Snedecor's $\mathcal{F}_{m,n}$.
    (c) Gamma distribution, $\gamma(a, r)$.
    (d) Chi square distribution, χ^2_n.

16. The probability that a pregnancy is terminated accidentally during a rutinary exploration is 1%. In 80 such explorations are carried per day in a hospital, the number of daily miscarriages will be approximately distributed as:

    (a) Poisson, with $\lambda = 0.01$.
    (b) Poisson, with $\lambda = 0.8$.
    (c) Normal, with $m = 0.8$ and $\sigma^2 = 0.08 \times 0.99$.
    (d) All other answers are false.

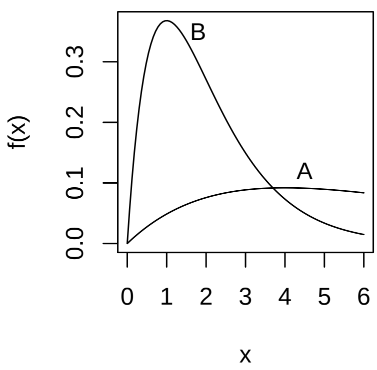
17. The exponential distribution *could* be a good model for:

    (a) Lengths of time between successive occurrences of an event, such as the collision of two planes in flight.
    (b) The number of times something happens in a time interval of fixed length.
    (c) Observed temperatures in Bilbao, when we measure in Celsius degrees.
    (d) The goals scored by the Athletic in a given season.
    (e) All other answers are false.

18. Remember the density function of the $\gamma(a, r)$ is given by:

$$f(x) = \frac{a^r}{\Gamma(r)} x^{r-1} e^{-ax}$$

Look closely at the two gamma $\gamma(a, r)$ densities in the graph, which share a common value of r. Which one do you think has the largest a parameter?



    (a) Density A.
    (b) Clearly the two densities do not share the same value of r.
    (c) Density B.
    (d) Both have the same a.

eman ta zabal zazu

Universidad del País Vasco
Euskal Herriko Unibertsitatea

DIRECTIONS

1. Correctly answered questions give one point. There is only one correct answer to each question. Questions not correctly answered carry a penalty of -0.20 points, so it is better to leave a question unanswered rather than giving a wrong answer.
2. Our goal is to gauge your understanding and command of concepts learned during the course, not your visual sharpness. It is a fact, though, that in a multiple choice exam great attention has to be paid to the details. It is quite common that knowledgeable students waste their chances of a good grade because they do not pay sufficient attention to the precise wording of questions.

Please, do yourself a favour and read carefully before you answer!

3. It will probably help you to discard first answers that are clearly inadequate.
4. Students scoring 10 points or better in this exam will earn a full 0.75 points of their final grade.
5. The time scheduled for this exam is 1h.

Do not turn the page until advised to do so!
Mark the type of your exam on the orange sheet NOW!!

Answers for the exam of type $\boxed{1}$

Section 1. Multiple choice questions

START OF A QUESTION BLOCK

Questions up until the next horizontal line refer to the same situation, described in the question next.

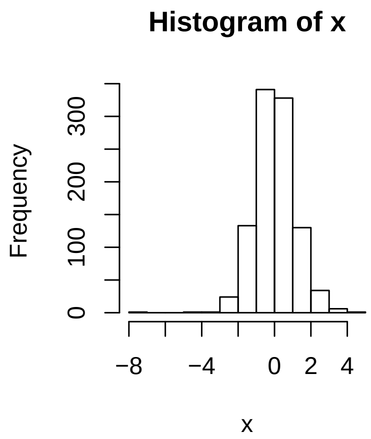
1. You visit Las Vegas, and enter one casino. There, you find two machines, both of them accepting bets of \$10. The prize in dollars you get for your bet is $\gamma(a = 1, r = 5)$ distributed in the first case and $\mathcal{P}(\lambda = 5)$ distributed in the second. What is the expected net return (prize - bet) if you play once?
   - (a) \$5
   - (b) \$7
   - (c) -\$3
   - (d) -\$7
   - **(e) -\$5**
2. Which of the two machines can more likely produce a prize in excess of \$10.25?
   - **(a) The machine with $\gamma(a = 1, r = 5)$ prizes.**
   - (b) The machine with $\mathcal{P}(\lambda = 5)$ prizes.
   - (c) Both machines produce such prizes with the same probability.
   - (d) No machine can produce such prize.
   - (e) Cannot tell.

END OF A QUESTION BLOCK

---

3. Invoking the central limit theorem, we can be confident that for large degrees of freedom n, the distribution χ^2_n will be fairly well approximated by:
   - **(a) A $N(n, 2n)$ distribution.**
   - (b) A $\gamma(n, 2n)$.
   - (c) It will be exactly a $\gamma(n, 2n)$; this has nothing to do with the central limit theorem.
   - (d) A normal, $N(a, \sigma^2 = r^2/a)$, where a and r are the parameters of the "mother" $\gamma(a, r)$.
   - (e) All other answers are false.
4. The Poisson distribution *could* be a good model for:
   - (a) Lengths of time between successive occurrences of an event, such as the collision of two planes in flight.
   - **(b) The number of times something happens in a time interval of fixed length.**
   - (c) Observed temperatures in Bilbao, when we measure in Celsius degrees.
   - (d) The difference of goals scored and received by a football team in a given season.
   - (e) All other answers are false.
5. The sum of independent variables with gamma distribution $\gamma(a, r)$ is again a gamma distribution, under certain conditions. Which of the following, if any, is true? (In the symbolic equalities below, the left hand side denotes the distribution of the sum, the terms in the right hand side the distributions of the variables added.)
   - **(a)** $\gamma(a, r_1 + \ldots + r_n) = \gamma(a, r_1) + \ldots + \gamma(a, r_n)$
   - (b) $\gamma(a_1 + \ldots + a_n, r) = \gamma(a_1, r) + \ldots + \gamma(a_n, r)$
   - (c) $\gamma(a_1 + \ldots + a_n, r_1 + \ldots + r_n) = \gamma(a_1, r_1) + \ldots + \gamma(a_n, r_n)$
   - (d) All other answers are false.
6. The parameter λ of a Poisson distribution $\mathcal{P}(\lambda)$ is:
   - (a) The mode of the distribution.
   - (b) Always an integer number.
   - **(c) The mean and the variance of the distribution.**
   - (d) The mean and standard deviation of the distribution.

7. Look at the following histogram, of a random sample from an unknown distribution. Among the distributions listed next, only one could possible have produced such histogram.



(a) $\mathcal{F}_{4,5}$

(b) t_{10}

(c) χ^2_5

(d) Square-normal.

(e) Poisson, $\mathcal{P}(\lambda = 3)$.

8. The form of the probability function for the Poisson $\mathcal{P}(\lambda)$ distribution is easy enough to allow you to compute Prob(X) when $X \sim \mathcal{P}(\lambda = 1.35)$ with only a pocket calculator. What is the approximate value of Prob($X = 4$) in that case?

(a) 0.02322

(b) 0.01223

(c) 0.03588

(d) 0.12934

9. Let $\mathcal{F}^{\alpha}_{m,n}$ be the value leaving a tail of probability α in an Snedecor's $\mathcal{F}$ distribution with m and n degrees of freedom. Which of the following is true?

(a) $\mathcal{F}^{\alpha}_{m,n} = \mathcal{F}^{1-\alpha}_{n,m}$

(b) $\mathcal{F}^{\alpha}_{m,n} = 1/\mathcal{F}^{1-\alpha}_{n,m}$

(c) $\mathcal{F}^{\alpha}_{m,n} = 1 - \mathcal{F}^{\alpha}_{n,m}$

(d) $\mathcal{F}^{\alpha}_{m,n} = 1/\mathcal{F}^{\alpha}_{n,m}$

(e) All other answers are false.

10. Assuming $X \sim t_5$ and $Y \sim \chi^2_6$, mark the true inequality among the following:

(a) Prob($X > 4.54$) > 0.03

(b) Prob($Y > 16.8$) > 0.03

(c) Prob($Y > 16.8$) $<$ **Prob**($X > 2.57$)

(d) Prob($Y > 10.6$) > 0.95

(e) Prob($X < 2.57$) < 0.90

11. For large n, a binomial distribution $B(p, n)$ can be closely approximated by a normal, provided that:

(a) p is very small.

(b) np very close to zero.

(c) np **is large enough.**

(d) $np < 18$.

12. If $X \sim t_6$, the it is clear that X^2 is distributed as:

(a) χ^2_6

(b) t_{36}

(c) $(1/\sqrt{\chi^2_6/6})^2$.

(d) $\mathcal{F}_{1,6}$

(e) $\mathcal{F}_{6,1}$

13. Assume the number of people calling the 112 emergency number in one day is Poisson distributed. The average of daily calls in a week has been 80. What would be your best guess about the value of λ?

(a) 80

(b) 80^2

(c) $\sqrt{80}$

(d) All other answers are false.

14. The capital city of Spain is:

(a) Paris.

(b) Pekín.

(c) Madrid.

(d) Kuala Lumpur.

15. Which of the following distributions is obviously ***not*** a good candidate as a model for the distribution of prices at which stocks are traded?

    (a) **Student's t_n.**

    (b) Snedecor's $\mathcal{F}_{m,n}$.

    (c) Gamma distribution, $\gamma(a, r)$.

    (d) Chi square distribution, χ^2_n.

16. The probability that a pregnancy is terminated accidentally during a rutinary exploration is 1%. In 80 such explorations are carried per day in a hospital, the number of daily miscarriages will be approximately distributed as:

    (a) Poisson, with $\lambda = 0.01$.

    (b) **Poisson, with $\lambda = 0.8$.**

    (c) Normal, with $m = 0.8$ and $\sigma^2 = 0.08 \times 0.99$.

    (d) All other answers are false.

17. The exponential distribution *could* be a good model for:

    (a) **Lengths of time between successive occurrences of an event, such as the collision of two planes in flight.**

    (b) The number of times something happens in a time interval of fixed length.

    (c) Observed temperatures in Bilbao, when we measure in Celsius degrees.

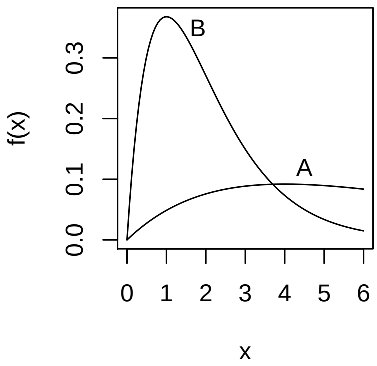
    (d) The goals scored by the Athletic in a given season.

    (e) All other answers are false.

18. Remember the density function of the $\gamma(a, r)$ is given by:

$$f(x) = \frac{a^r}{\Gamma(r)} x^{r-1} e^{-ax}$$

Look closely at the two gamma $\gamma(a, r)$ densities in the graph, which share a common value of r. Which one do you think has the largest a parameter?



(a) Density A.

(b) Clearly the two densities do not share the same value of r.

(c) **Density B.**

(d) Both have the same a.