STATISTICS FOR BUSINESS

Solved examination, June 4, 2018

Faculty of Economics and Business, Donostia

University of the Basque Country

Author and professor of the subject:
Josemari Sarasola

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Foreign students that took the June 4 examination: Daniela Klapalkova and Krystina Kucerova (Usti nad Labem, Czech Republic), Mirjam Roth (Germany), Catalina Ivanov (Moldova) and Julia Van Hooren (The Netherlands). Krystina Kucerova got the highest score in the multiple choice test in the English classroom with 11 correct answers of 20. Wesley Bouw (Belgium), Young Eun An and Juyoung Lee (Korea) took the special exam before the official exam (May 18 exam).

STATISTICS FOR BUSINESS

Professor: Josemari Sarasola

Date: June 4, 2018, 10:00

1st problem: newspaper vendor's problem *(2 points)*

Aside from cell phones, Xiaomi sells also electric scooters and bycicles, but only in China nowadays. Nevertheless, sometimes some batches of electric bicycles arrive to Europe by means of an agent. We have received an offer from an agent, but we have to decide fastly and only once, because in the next weeks a new model of bicycle will be produced, so that we will have to sell bicycles not sold in the following 4 weeks at a special offer price of 200 € per unit.

In the next 4 weeks we will sell at least 2 bicycles, previously booked by our customers. Sales along next 4 weeks, including those 2 units, distribute in this way:

Units (x)	Probability($p(x)$)
2	0.2
3	0.3
4	0.2
5	0.2
6	0.1
	1

We buy the bicycles at a price of 400 € per unit, and sell them at a price of 700 €, but if we take 5 bicycles or more, the agent will give a us a discount of 50 € per unit for all of them (so the unit cost will be 350 €).

Tasks to perform:

(a) In order to maximize the expected benefits, give the optimal number of units to buy.

(b) Calculate the variance of benefits, if we buy 6 bicycles.

2nd problem: CLT *(2 points)*

Daily sales of a firm distribute uniformly in the 300-500 (€) interval.

Tasks to perform:

(a) Calculate the maximum sales number with a 97.5% probability.

(b) The goal is to reach 50.000 € sales. How many days do we need to reach the goal with a 97.5% probability.

Hint: $ax^2 + bx + c = 0 \rightarrow x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

3rd problem: validation *(2 points)*

We have collected data bout the number of failures in a factory along the last 15 days:

7 - 4 - 3 - 5 - 8 - 2 - 6 - 4 - 2 - 7 - 6 - 3 - 6 - 4 - 8

Task to perform: Applying chi-square test, may we state that data follow a Poisson distribution? Significance level: 5%.

Hints:

- Along with $2, 3, 4, \ldots, 8$ values, take also (< 2) and (> 8) intervals to cover all the possible values for Poisson distribution.
- Estimate λ by means of the arithmetic mean.
- If you don't want to calculate probabilities by hand, you may take Poisson probabilities from this R output: `> x=c(0:8)`

```
> dpois(x,5)
0.006737947 0.033689735 0.084224337 0.140373896 0.175467370 0.175467370

0.146222808 0.104444863 0.065278039
> round(dpois(x,5),digits=3)
0.007 0.034 0.084 0.140 0.175 0.175 0.146 0.104 0.065
```

4th problem: parametric testing *(2 points)*

We have collected a random sample about daily production in a factory (tons):

32-36-34-38-40-41

We suppose daily production distributes following a normal distribution.

Tasks to perform:

(a) Production planning requirements state that average daily production should be at least 38 tons, but we think that requirement is not fulfilled. Take a decision about that at a 10% significance level.

(b) Test if average daily production is exactly 35 tons. Significance level: 10%.

1st problem: newspaper vendor's problem *(2 points)*

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In the next 4 weeks we will sell at least 2 bicycles, previously booked by our customers. Sales along next 4 weeks, including those 2 units, distribute in this way:

Units (x)	**Probability($p(x)$)**
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3	**0.3**
4	**0.2**
5	**0.2**
6	**0.1**
	1

We buy the bicycles at a price of 400 € per unit, and sell them at a price of 700 €, but if we take 5 bicycles or more, the agent will give a us a discount of 50 € per unit for all of them (so the unit cost will be 350 €).

Tasks to perform:

(a) In order to maximize the expected benefits, give the optimal number of units to buy.

(b) Calculate the variance of benefits, if we buy 6 bicycles.

(a)

Whenever we sell 2, 3, or 4 cycles, benefit for each cycle is 700-400=300 €. If we sell 5 or 6 cycles, benefit will be 700-350=350 €.

Buying 2 cycles

Sold cycles (y)	Benefit (z)	Probabilities ($p(y) = p(z)$)	$zp(z)$
2	$2 \times 300 = 600$	1	600
		1	$\mu = 600$

Buying 3 cycles

Sold cycles (y)	Benefit (z)	Probabilities ($p(y) = p(z)$)	$zp(z)$
2	$2 \times 300 - 1 \times 200 = 400$	0.2	80
3	$3 \times 300 = 900$	0.8	720
		1	$\mu = 800$

Buying 4 cycles

Sold cycles (y)	Benefit (z)	Probabilities ($p(y) = p(z)$)	$zp(z)$
2	$2 \times 300 - 2 \times 200 = 200$	0.2	40
3	$3 \times 300 - 1 \times 200 = 700$	0.3	210
4	$4 \times 300 = 1200$	0.5	600
		1	$\mu = 850$

Buying 5 cycles

Sold cycles (y)	Benefit (z)	Probabilities ($p(y) = p(z)$)	$zp(z)$
2	$2 \times 350 - 3 \times 150 = 250$	0.2	50
3	$3 \times 350 - 2 \times 150 = 750$	0.3	225
4	$4 \times 350 - 1 \times 150 = 1250$	0.2	250
5	$5 \times 350 = 1750$	0.3	525
		1	$\mu = 1050$

Buying 6 cycles

Sold cycles (y)	Benefit (z)	Probabilities ($p(y) = p(z)$)	$zp(z)$
2	$2 \times 350 - 4 \times 150 = 100$	0.2	20
3	$3 \times 350 - 3 \times 150 = 600$	0.3	180
4	$4 \times 350 - 2 \times 150 = 1100$	0.2	220
5	$5 \times 350 - 1 \times 150 = 1600$	0.2	320
6	$6 \times 350 = 2100$	0.1	210
		1	$\mu = 950$

The optimal choice is buying 5 cycles with an average benefit of 1050 €.

(b) Calculation of variance:

z	$p(z)$	$zp(z)$	$z^2p(z)$
100	0.2	20	2000
600	0.3	180	108000
1100	0.2	220	242000
1600	0.2	320	512000
2100	0.1	210	441000
	1	$\alpha_1 = \mu = 950$	$\alpha_2 = 1305000$

Hence:

$$\sigma^2 = \alpha^2 - \alpha_1^2 = 1305000 - 950^2 = 402500$$

2nd problem: CLT *(2 points)*

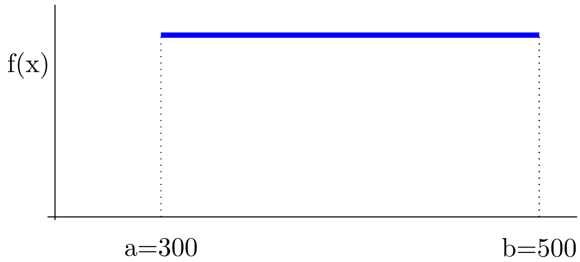
Daily sales of a firm distribute uniformly in the 300-500 (€) interval.

Tasks to perform:

(a) Calculate the maximum sales number with a 97.5% probability.

(b) The goal is to reach 50.000 € sales. How many days do we need to reach the goal with a 97.5% probability.

Hint: $ax^2 + bx + c = 0 \rightarrow x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$



(a)

$X_1 \sim U(300, 500)$
$X_2 \sim U(300, 500)$
....
$X_{80} \sim U(300, 500)$

Daily sales:

$$\mu = \frac{a+b}{2} = \frac{300+500}{2} = 400$$

$$\sigma^2 = \frac{(b-a)^2}{12} = \frac{(500-300)^2}{12} = 3333.33$$

Applying CLT, sales along 80 days distribute in this way:

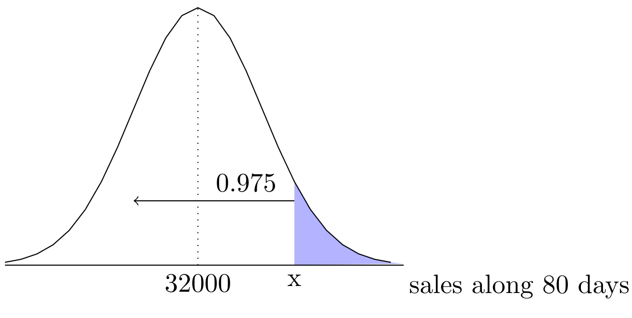
$$\mathbf{X} \sim N(80 \times 400 = 32000, \sqrt{80 \times 3333.33}) : N(32000, 516.4)$$

As we are looking for the maximum:

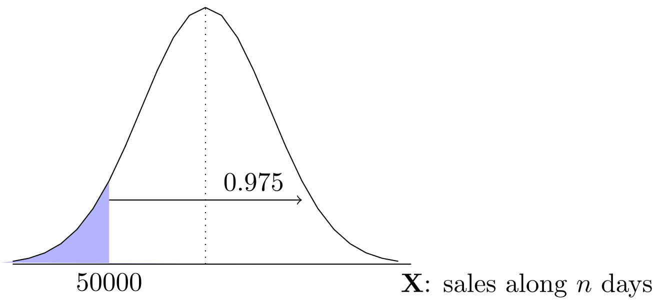
$$P[\mathbf{X} \leq x] = P\left[Z < \frac{x - 32000}{516.4}\right] = 0.975$$

$$P[Z \leq z] = 0.975 \rightarrow z = 1.96$$

$$1.96 = \frac{x - 32000}{516.4} \rightarrow x = 33012.14 \ euro$$



(b)



$$\mathbf{X} \sim N(400n, \sqrt{3333.33n} = 57.73\sqrt{n})$$

$$P[X > 50000] = P\left[Z > \frac{50000 - 400n}{57.73\sqrt{n}}\right] = 0.975$$

$$\frac{50000 - 400n}{57.73\sqrt{n}} = -1.96 \longrightarrow 400n - 113.16\sqrt{n} - 50000 = 0$$

$$\xrightarrow[\sqrt{n}=x]{} 400x^2 - 113.16x - 50000$$

$$\rightarrow x = 11.32 \rightarrow n = 128.14 \rightarrow 129 \ days$$

3rd problem: validation *(2 points)*

We have collected data bout the number of failures in a factory along the last 15 days:

7 - 4 - 3 - 5 - 8 - 2 - 6 - 4 - 2 - 7 - 6 - 3 - 6 - 4 - 8

Task to perform: Applying chi-square test, may we state that data follow a Poisson distribution? Significance level: 5%.

Hints:

- **Along with** $2, 3, 4, \dots, 8$ **values, take also** (< 2) **and** (> 8) **intervals to cover all the possible values for Poisson distribution.**
- **Estimate** λ **by means of the arithmetic mean.**
- **If you don't want to calculate probabilities by hand, you may take Poisson probabilities from this R output:**

```
> x=c(0:8)
> dpois(x,5)
0.006737947 0.033689735 0.084224337 0.140373896 0.175467370 0.175467370

0.146222808 0.104444863 0.065278039
> round(dpois(x,5),digits=3)
0.007 0.034 0.084 0.140 0.175 0.175 0.146 0.104 0.065
```

H_0: Poisson distribution fits the data

As we don't know lambda parameter, we have to estimate it. Lambda is the mean for the Poisson distribution, so the logical estimator is the arithmetic mean:

$$\hat{\mu} = \hat{\lambda} = \frac{7+4+3+\cdots+8}{15} = \frac{75}{15} = 5$$

We calculate theoretical probabilities for the Poisson distribution:

$P[X=0] = \dfrac{e^{-5}5^0}{0!} = 0.0067$

$P[X=1] = \dfrac{e^{-5}5^1}{1!} = 0.0337$

$P[X=2] = \dfrac{e^{-5}5^2}{2!} = 0.0842$

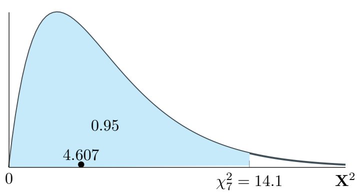
....

Values	Observed freq. (O_i)	Prob. (p_i)	Expected freq. (E_i)	$\frac{(O_i - E_i)^2}{E_i}$
< 2	0	0.0404(*)	0.606	0.606
2	2	0.0842	1.263	0.430
3	2	0.1404	2.106	0.005
4	3	0.1755	2.633	0.051
5	1	0.1755	2.633	1.012
6	3	0.1462	2.193	0.297
7	2	0.1044	1.566	0.120
8	2	0.0653	0.980	1.063
> 8	0	0.0681(**)	1.022	1.022
	15	1	15	$\mathbf{X}^2 = 4.607$

(*): 0.0404=0.0067+0.037

(**): 0.0681=1-0.0404-0.0842-...-0.0653

We compare the value for $\mathbf{X}^2$ statistics with it's distribution in the chi-square table. Degrees of freedom are 9-1-1=7.



As we have $4.607 < 14.1$, we accept the null hypothesis, so we accept Poisson for data with that significance level.

4th problem: parametric testing *(2 points)*

We have collected a random sample about daily production in a factory (tons):

32-36-34-38-40-41

We suppose daily production distributes following a normal distribution.

Tasks to perform:

(a) **Production planning requirements state that average daily production should be at least 38 tons, but we think that the requirement is not fulfilled. Take a decision about that at a 10% significance level.**

(b) **Test if average daily production is exactly 35 tons. Significance level: 10%.**

(a)

As we think that $\mu < 38$ (requirement is not fulfilled), by caution we take the opposite as the null hypothesis: $H_0 : \mu > 38$ (requirement is fulfilled).

Population is normal and standard deviation is not known, so we must calculate the t statistic and its distribution:

$$t = \frac{\overline{x} - \mu}{\hat{s}/\sqrt{n}} \sim t_{n-1}$$

$$\overline{x} = \frac{32 + 36 + 34 + 38 + 40 + 41}{6} = \frac{221}{6} = 36.83$$

$$\hat{s} = \sqrt{\frac{(32-36.83)^2 + (36-36.83)^2 + (34-36.83)^2 + (38-36.83)^2 + (40-36.83)^2 + (41-36.83)^2}{6-1}} = 3.49$$

$$t = \frac{\overline{x} - \mu}{\hat{s}/\sqrt{n}} = \frac{36.83 - 38}{3.49/\sqrt{6}} = -0.75$$

We reject $H_0 : \mu > 38$ when $\overline{x}$ and so t is very small, so the rejection region is on the lower side. As the significance level is 0.1, we must look for the percentile in the t_{6-1} distribution that leaves below it a 0.1 probability: $t_{6-1,0.9} = -1.48$.

So the rejection region is $t < -1.48$. As we have $t = -0.75$, we accept $H_0 : \mu > 38$ and so decide there isn't strong enough evidence to deny that the requirement is fulfilled.

(b)

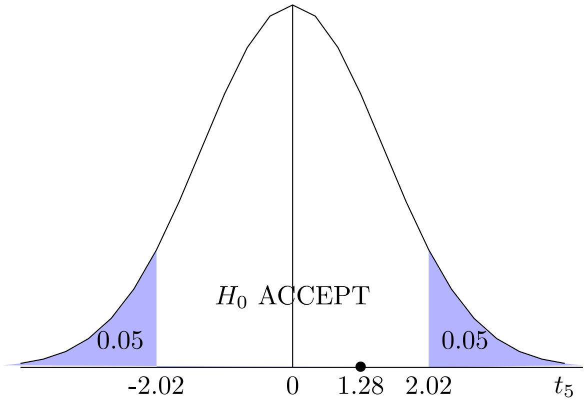
Now we have $H_0 : \mu = 35$.

We calculate the t statistic:

$$t = \frac{\overline{x} - \mu}{\hat{s}/\sqrt{n}} = \frac{36.83 - 35}{3.49/\sqrt{6}} = 1.28$$

The test is two-sided so we must leave 5% probability on each tail of the corresponding t_5 distribution.

Hence, critical values are: $\pm t_{n-1,\alpha/2} \rightarrow \pm t_{5,0.05} = \pm 2.02$



As t statistic is within the ± 2.02 range, we accept $H_0 : \mu = 35$.

STATISTICS FOR BUSINESS

Teacher: Josemari Sarasola

Date and hour: June 4, 2018, 15:00

Duration: 35 minutes

Only one answer in correct in each question. The overall score for the test is 2 points. For each correct answer you get 0.1 point. For each wrong answer you are penalized with 0.05 points. If you don't answer a question, you neither get nor lose points.

1. How many 4-digit codes can you set with 1, 2, 3, 4, 5, 6 and 7 digits, being all digits in the code different?
   (a) 70
   (b) 210
   (c) 343
   (d) All previous choices are wrong.

2. Simplify $(A - B) \cap B$.
   (a) $\emptyset$ (empty set)
   (b) A
   (c) B
   (d) $A \cap B$

3. Calculate $\binom{m}{3}$.
   (a) $m(m-1)(m-2)$
   (b) $m(m-1)(m-2)(m-3)$
   (c) $m(m-1)(m-2)/3$
   (d) $m(m-1)(m-2)/6$

4. Into an urn, you have 4 faultless and 1 faulty item. 2 items are drawn randomly. What is the probability of having *at most* 1 faulty item among them?
   (a) 1
   (b) 0.5
   (c) 0.33
   (d) 0.66

5. There is famine in Senegal. Along the last three months many children under 5 have died. How should you calculate the probability of no child under 5 dying tomorrow?
   (a) There is always absolute uncertainty about death, and as yes/no are the possible events about death, probability is 0.5.
   (b) Taken death statistics of the last three months, by counting how many days have been without child death.
   (c) Taking into account several factors, as food reserves and weather forecast.
   (d) We can't calculate it, because we never know when death is arriving. It's God's will. The only thing we can do is to take action in order to that probability being 0, or at least as small as possible.

6. $P(A_i)$ are a priori probabilities, eta B the information we get. How do you calculate a posteriori probabilities by means of Bayes' theorem?
   (a) $\dfrac{P(A_i)}{\sum_i P(B/A_i)}$
   (b) $\dfrac{P(A_i)P(B)}{\sum_i P(B/A_i)}$
   (c) $\dfrac{P(B/A_i)}{\sum_i P(B)P(A_i/B)}$
   (d) $\dfrac{P(A_i)P(B/A_i)}{\sum_i P(A_i)P(B/A_i)}$

7. We have to apply Bayes' theorem with these a priori probabilities: $P(A_1) = 0.3$ eta $P(A_2) = 0.7$. On the other hand, it's more probable the occurrence of B conditioning by A_1 than conditioning by A_2. Which is the correct answer?
   (a) We cannot state if a posteriori probability of A_1 will decrease or increase, because a priori probabilities and verosimilities have different directions.
   (b) We cannot state with that information if a posteriori probability for A_1 is bigger than that for A_2.
   (c) A posteriori probability for A_1 is bigger that the corresponding a priori probability.
   (d) (b) and (c) are true.

8. In Donostia, the probability for a person being our customer is 0.4. Customers that asked for additional information are 70%. Amog people that are not our customers, those that asked for information are 20%. If a person asked for additional information, what is the probability of being a customer?
   (a) 0.7
   (b) 0.6
   (c) 0.5
   (d) 0.4

9. The number of times a person uses an appl for the cell phone in a day distributes in this manner: $F(x) = 1 - (\frac{1}{3})^x$; $x = 1, 2, 3, \ldots$. Calculate the probability of using the app twice in a day.
   (a) 2/3
   (b) 1/3
   (c) 2/9
   (d) 8/9

10. $F(x) = \dfrac{x^3}{k}$; $0 < x < 2$. Calculate k, so that $F(x)$ is a distribution function.
    (a) 3
    (b) 6
    (c) 8
    (d) $F(x)$ cannot be in any case a distribution function.

11. What is the most likely sequence for the next 6 babies born in the Basque Country (B=boy, G=girl)
    (a) BGBGBG
    (b) BGGBGG
    (c) BBBGGG
    (d) All given sequences have the same probability.

12. $f(x) = \frac{x}{8}$; $0 < x < 4$. Calculate $P[X > 2]$.
    (a) 0.25
    (b) 0.50
    (c) 0.75
    (d) All previous choices are wrong.

13. $f(x) = \frac{x}{8}$; $0 < x < 4$. Calculate the expected value.
    (a) 1.66
    (b) 2.66
    (c) 3.66
    (d) All previous choices are wrong.

14. These are the expected returns and its variances for A, B and C investments: $\mu_A = 4, \sigma_A = 2$, $\mu_B = 3, \sigma_B = 1$, $\mu_C = 2, \sigma_C = 0.75$. Which is the best one in the long term?
    (a) A
    (b) B
    (c) C
    (d) We need a utility function to assert which is the best one.

15. Here what we know about a random variable: $\mu = 4, \sigma = 1$. Approximate $P[X \leq 2]$.
    (a) $P[X \leq 2] \leq 0.125$
    (b) $P[X \leq 2] \leq 0.25$
    (c) $P[X \leq 2] \leq 0.75$
    (d) All previous choices are wrong.

16. The probability of selling 4 units or more in a given day is 0.2. How do you calculate with R software the probability of having among 10 days 3 days selling each of them 4 units or more.
    (a) `dbinom(3,4,10,0.2)`
    (b) `dbinom(3,10,0.2,lower.tail=F)`
    (c) `pbinom(3,4,10,0.2)`
    (d) `dbinom(3,10,0.2)`

17. The probability of producing a faulty item is 0.2. What is the probability of having 4 faultless items before the first faulty one?
    (a) 0.081
    (b) 0.0016
    (c) 0.4096
    (d) All previous choices are wrong.

18. The probability of producing a faulty item is 0.4. What is the probability of having 4 faulty items before the second faultless item?
    (a) 0.04608
    (b) 0.05608
    (c) 0.06608
    (d) All previous choices are wrong.

19. Daily production may be 1 or 2, with 0.3 and 0.7 probabilities respectively. Calculate the variance.
    (a) 0.01
    (b) 0.11
    (c) 0.21
    (d) 0.31

20. Which is false about the expected value?
    (a) It's unique.
    (b) It holds in the long term.
    (c) It's always known or we can calculate it.
    (d) It's a parameter.

A model

Statistics for Business

-

June 4, 2018

Name: Josemari Sarasola

Question	Answer
1	B
2	A
3	D
4	A
5	B
6	D
7	D
8	A
9	C
10	C
11	D
12	C
13	B
14	A
15	B
16	D
17	A
18	A
19	C
20	C

	Number of
RIGHT	10
WRONG	0
NOT ANSWERED	0

STATISTICS FOR BUSINESS

Special exam for students leaving before official exam

Teacher: Josemari Sarasola

Date: May 18, 2018

Completion time: 100 min

1st problem

In a factory there may be a production of 2 or 3 units on a first day with 0.4 and 0.6 probabilities. If production in that day is 2, the next day we take another machine which may produce 1 or 2 units in a day with 0.3 and 0.7 probabilitities, independently from the main production; otherwise, the production remains the same and the previous day. On the third day is the same: if production was 2 units we take another machine, otherwise not.

Tasks to perform:

1. Draw the probability tree for 3 days and set the probability distribution as a table for the production along those 3 days.
2. Calculate the expected production and the variance for the production on those 3 days.

2nd problem

Into an urn we have 10 faultless and 5 faulty items. We draw randomly 4 pieces at once. Calculate the probability of having at most 3 faulty items among them:

1. using combinatoric formula;
2. multiplying simple probabilities.

3rd problem

De Moivre-Laplace theorem. Our main supplier claims that the percentage of faulty items we receive is at most 8%. Among 200 pieces we have found 20 faulty items.

Tasks to perform:

1. May we accept the supplier's claim? Significance level: 2%.
2. Calculate the critical value for the same significance level.

4th problem *Parametric test about the population mean.* Daily energy consumption in our factory follows a normal distribution, with unknown standard deviation. In order to save energy, the parent company required for this year a maximum mean consumption of 40 kwH. We have measured comsuption for some days (KwH):

45-52-38-42

With those data, decide if we have reached the goal. Significance level: 8%.

STATISTICS FOR BUSINESS

Professor: Josemari Sarasola

July 6, 2018, 15:00

Duration: 120 min (estimate).

First name:	Last name:

1st problem: probability tree *(2 points)*

The manager of a small hotel thinks that next weekend there may be 0, 1 edo 2 double room reservations, with 0.2, 0.5 and 0.3 probabilities respectively. Each reservation has a a probability of 0.4 to renw the reservation for the next night.

Tasks to perform:

(a) Give the possible number of day sojourns for the weekend and its probabilities by means of a probability tree.

(b) Merge the previous result in a table and calculate the expected value and variance of the number of sojourns.

2nd problem: Poisson distribution, exponential distribution and CLT *(2 points)*

In a machine 2.4 failures are expected to occur per hour. Failures occur randomly and independently.

Tasks to perform:

(a) Calculate the probability of having more than 200 failures in the next 100 hours.

(b) The time needed to repair a failure distributes exponentially, with a mean time (remember!: mean *time*) of 1 hour. In order to repair 100 failures, how much time do we need at least to repair them with a 0.98 probability?

3rd problem: validation *(2 points)*

Sales totals have been collected along 11 days in a shop (dollars):

202 - 225 - 240 - 390 - 380 - 325 - 205 - 220 - 275 - 341 - 398

Tasks to perform:

(a) Test if data are independent among them. Significance level: 5%.

(b) Test if data fit to a normal distribution with mean 291 and standard deviation 77.7. Remark: set 200-250, 250-300, 300-350, 350-400 intervals and complete them with upper and lower intervals. Significance level: 2.5%.

4th problem: parametric testing *(2 points)*

A supplier claims that at most 1% of the pieces supplied are faulty. We have inspected 400 pieces and 7 among them were faulty.

Tasks to perform:

(a) Test $H_0 : p < 0.01$. Significance level: 2.5%.

(b) Test $H_0 : p = 0.01$. Significance level: 5%.

STATISTICS FOR BUSINESS

Teacher: Josemari Sarasola

Date and hour: July 6, 2018, 15:00

Duration: 35 minutes

Only one answer in correct in each question. The overall score for the test is 2 points. For each correct answer you get 0.1 point. For each wrong answer you are penalized with 0.05 points. If you don't answer a question, you neither get nor lose points.

1. In a garage we have 8 damaged cars and today we have to choose 2 among them to repair. In how many way can we choose them?
   (a) 16
   (b) 28
   (c) 32
   (d) 56
2. In a small hotel there are 2 reservations for the next 4 days, but we don't know the incoming day. How many ways are there for the reservations to come in?
   (a) 8
   (b) 16
   (c) 24
   (d) 32
3. Pilgrims arrive 3 times a week to a small village, but they come on random days. What is the probability of coming on Monday, Tuesday and Wednesday?
   (a) 0.018
   (b) 0.028
   (c) 0.038
   (d) 0.048
4. In an urn we have 4 faulty and 3 faulless items. We draw and at the same time 3 items . What is the probability of all of them being faulty?
   (a) 0.011
   (b) 0.022
   (c) 0.033
   (d) 0.044
5. A and B being mutually exclusive, simplify $A \cap B$.
   (a) A
   (b) B
   (c) Ω
   (d) Empty set.
6. In a village there are 100 men eta 200 women. Among them, there are 50 jobless. Amog men there 80 with a job. What is the probability for a woman having a job?
   (a) 0.15
   (b) 0.25
   (c) 0.40
   (d) All previous answers are wrong.
7. 12 persons have made the preregistration for a course. There are the same chances of finally registering and leaving. How should you calculate the probability of at least 6 persons finally making the registration?
   (a) By Laplace's rule.
   (b) Frequential method.

(c) Subjective probability.
(d) From experience and data of previous years.

8. An insurance company has 1000 customers: 600 men and 400 women. Men having an accident were 300, and women who had an accident 100. A customer had an accident. Give the probability of being a woman.
   (a) 0.25
   (b) 0.40
   (c) 0.50
   (d) 0.75

9. Which is wrong about statistical testing?
   (a) We prefer null hypothesis that give fixed and concrete values about a simple probability.
   (b) Significance level is probability of evidence (or something more amazing).
   (c) The bigger the significance level is, the easier we reject the null hypothesis.
   (d) Significance level is always previously set.

10. $P[A] = 0.4$; $P[B] = 0.3$; $P[C] = 0.2$; $P[A \cap B] = 0.1$; $P[A \cap C] = 0.1$; $P[B \cap C] = 0.1$; $P[A \cap B \cap C] = 0.1$. What is the probability of having at least one of A, B and C?
    (a) 0.5
    (b) 0.6
    (c) 0.7
    (d) 0.9

11. $F(x) = \frac{3x^4}{k}$; $0 \leq x \leq 2$. Set k for $F(x)$ to be a distribution function.
    (a) 6
    (b) 12
    (c) 24
    (d) 48

12. $P(X = x) = \frac{x}{k}$; $x = 1, 2, 3, 4, 5$. Set k for $P[X = x]$ to be a mass probability function.
    (a) 3
    (b) 5
    (c) 6
    (d) 15

13. $f(x) = \frac{x}{18}$; $0 < x < 6$. Give $P[X > 4]$.
    (a) 0.06
    (b) 0.13
    (c) 0.16
    (d) 0.33

14. We load 20 kg boxes in a truck. Loaded box number is random, and so the total weight. X total weight is taken as a continuous variable, and all possible weights have the same probability. How should you calculate the probability of having a total weight of 2000 kg?
    (a) That should be 0, as it0s a continuous ransom variable.
    (b) 20/2000=0.01
    (c) $P[1990 < X < 2010]$
    (d) $P[1980 < X < 2020]$

15. Which is wrong?

(a) When a continuous random variables takes many values, we take it as it were discrete.

(b) If parameters are unknown, we cannot calculate exact exact and concrete probabilities in a probability distribution.

(c) Usually, probability distributions are mathematical functions, in order to make the further developments easier.

(d) We can define a probability distribution without its exact parameter values.

16. A random variable takes 0 and a values with $1-p$ and p probabilities. Calculate the second raw moment.

(a) ap

(b) ap^2

(c) a^2p

(d) a^2p^2

17. About the returns of a stock, a big variance ...

(a) is nor relevant in the long term.

(b) in the short term means risk is small.

(c) in the long term means risk is big.

(d) should be analyzed with a utility function, in order to take a decision.

18. In the news vendor problem,

(a) we search for the number of items to buy, known the distribution of the demand.

(b) we search for the best value for the demand, for different number of items to buy.

(c) we search for the number of items to buy, for a fixed number of items in the demand.

(d) we search for the best value for the demand, for a fixed number of items to buy.

19. Probability for a faulty item is 0.4. If we produce 5 items, what is the probability of having at least one faulty item?

(a) 0.80

(b) 0.84

(c) 0.88

(d) 0.92

20. Probability for a faulty item is 0.2. How many faultless items do we expect till the second faulty item?

(a) 0.5

(b) 1

(c) 4

(d) 8

Statistics for Business

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July 6, 2018

Name:____

Question	Answer
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