Remember to include calculations. Show your work!

STOCKHOLM UNIVERSITY
Department of Statistics
Spring 2020

Ulf Högnäs (examiner)

EXAM – BASIC STATISTICS FOR ECONOMISTS

2020-06-03

Time: 9.00 - 15.00

Approved aid: Any books or notes. You are not allowed to communicate with anyone else during the exam. You are allowed to use Excel or other software to check your work, but you have to show calculations on paper.

NOTE: You will only be required to solve 6 out of 24 problems. Which 6 problems that you are asked to solve is specified on the next pages.

- **Problems 1 – 16 SHORT ANSWER SOLUTIONS – max 50 points**
  - Include all relevant calculations, formulas, and values that you use.
  - Check your calculations and solutions before submitting. Careless mistakes may result in unnecessary point deductions.
- **Problems 17 – 24**: **LONGER WRITTEN SOLUTIONS – max 50 points**
  - For full marks, clear, comprehensive and well-motivated solutions are required. Unclear and unexplained solutions may result in point deductions even if the final answer is correct.
  - Check your calculations and solutions before submitting. Careless mistakes may result in unnecessary point deductions.
- The maximum number of points is stated for each question. The maximum total number of points is 50 + 50 = 100. At least 50 points is required to pass (grades A-E). The grading scale may be adjusted toward more generous grades:

  A: 90 – 100 points

  B: 80 – 89 points

  C: 70 – 79 points

  D: 60 – 69 points

  E: 50 – 59 points

  Fx: 40 – 49 points

  F: 0 – 40 points

  NOTE! Fx and F are failing grades that require re-examination. Students who receive the grade Fx or F cannot supplement for a higher grade.
- Solutions will be posted on Athena after the exam. **GOOD LUCK!**

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Find your anonymous code in the table. Solve the problems listed on that row. Be careful to answer those and only those problems.

Anonymous Code	1-4	5-8	9-12	13-16	17-20	21-24
0002-GUH	1	5	9	13	17	21
0003-TAY	2	6	10	14	18	22
0004-HLN	3	7	11	15	19	23
0005-BHE	4	8	12	16	20	24
0006-BCZ	1	5	9	13	17	21
0007-EXG	2	6	10	14	18	22
0008-YGC	3	7	11	15	19	23
0009-UTZ	4	8	12	16	20	24
0010-GNF	1	5	9	13	17	21
0011-CWD	2	6	10	14	18	22
0012-LHL	3	7	11	15	19	23
0013-MDF	4	8	12	16	20	24
0014-MCS	1	5	9	13	17	21
0015-DHU	2	6	10	14	18	22
0016-HEX	3	7	11	15	19	23
0018-HTB	4	8	12	16	20	24
0019-JAM	1	5	9	13	17	21
0020-JLP	2	6	10	14	18	22
0021-EAW	3	7	11	15	19	23
0022-EJR	4	8	12	16	20	24
0023-SNM	1	5	9	13	17	21
0024-HWY	2	6	10	14	18	22
0025-TFH	3	7	11	15	19	23
0026-CDJ	4	8	12	16	20	24
0027-CWE	1	5	9	13	17	21
0028-DMX	2	6	10	14	18	22
0029-LHB	3	7	11	15	19	23
0030-CUT	4	8	12	16	20	24
0031-UCT	1	5	9	13	17	21
0032-RHC	2	6	10	14	18	22
0033-MCK	3	7	11	15	19	23
0034-JKY	4	8	12	16	20	24
0035-KSA	1	5	9	13	17	21
0036-FSC	2	6	10	14	18	22
0037-CYK	3	7	11	15	19	23
0038-ZXW	4	8	12	16	20	24
0039-ACN	1	5	9	13	17	21

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0040-CYP	2	6	10	14	18	22
0041-UZZ	3	7	11	15	19	23
0042-KCH	4	8	12	16	20	24
0043-JME	1	5	9	13	17	21
0044-FOD	2	6	10	14	18	22
0045-ULH	3	7	11	15	19	23
0046-DDN	4	8	12	16	20	24
0047-ZYL	1	5	9	13	17	21
0048-AOO	2	6	10	14	18	22
0049-XLU	3	7	11	15	19	23
0050-AGL	4	8	12	16	20	24
0051-KRY	1	5	9	13	17	21
0052-THJ	2	6	10	14	18	22
0053-KPE	3	7	11	15	19	23
0054-PYN	4	8	12	16	20	24
0055-SFK	1	5	9	13	17	21
0056-FPD	2	6	10	14	18	22
0057-BFF	3	7	11	15	19	23
0058-PAA	4	8	12	16	20	24
0060-YPO	1	5	9	13	17	21
0061-ZOA	2	6	10	14	18	22
0062-EEW	3	7	11	15	19	23
0063-AWC	4	8	12	16	20	24
0065-EJK	1	5	9	13	17	21
0066-XAS	2	6	10	14	18	22
0067-FCN	3	7	11	15	19	23
0068-NFE	4	8	12	16	20	24
0069-NZT	1	5	9	13	17	21
0070-XRY	2	6	10	14	18	22
0071-WYE	3	7	11	15	19	23
0073-MXD	4	8	12	16	20	24
0074-BXH	1	5	9	13	17	21
0075-FEN	2	6	10	14	18	22
0076-LOA	3	7	11	15	19	23
0077-CYJ	4	8	12	16	20	24
0078-WLL	1	5	9	13	17	21
0079-YKO	2	6	10	14	18	22
0080-PSW	3	7	11	15	19	23
0081-AMD	4	8	12	16	20	24
0082-ZTT	1	5	9	13	17	21
0083-CUZ	2	6	10	14	18	22

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0084-JDH	3	7	11	15	19	23
0085-JDL	4	8	12	16	20	24
0086-BXF	1	5	9	13	17	21
0087-DLU	2	6	10	14	18	22
0088-GDD	3	7	11	15	19	23
0089-NTY	4	8	12	16	20	24
0090-ZMZ	1	5	9	13	17	21
0091-BUB	2	6	10	14	18	22
0092-XUF	3	7	11	15	19	23
0093-UOM	4	8	12	16	20	24
0094-SKZ	1	5	9	13	17	21
0096-JDX	2	6	10	14	18	22
0097-GOR	3	7	11	15	19	23
0098-RGC	4	8	12	16	20	24
0099-XCT	1	5	9	13	17	21
0100-JHL	2	6	10	14	18	22
0101-ZAH	3	7	11	15	19	23
0102-BBE	4	8	12	16	20	24
0103-UPD	1	5	9	13	17	21
0104-CPX	2	6	10	14	18	22
0105-MRC	3	7	11	15	19	23
0106-SNX	4	8	12	16	20	24
0107-JPP	1	5	9	13	17	21
0108-ONM	2	6	10	14	18	22
0109-YUN	3	7	11	15	19	23
0110-CNJ	4	8	12	16	20	24
0111-CJL	1	5	9	13	17	21
0112-UMX	2	6	10	14	18	22
0113-XMS	3	7	11	15	19	23
0114-AMU	4	8	12	16	20	24
0115-DPX	1	5	9	13	17	21
0116-XEP	2	6	10	14	18	22
0117-PEG	3	7	11	15	19	23
0118-UPE	4	8	12	16	20	24
0119-NJZ	1	5	9	13	17	21
0120-KLB	2	6	10	14	18	22
0122-KKE	3	7	11	15	19	23
0123-HUS	4	8	12	16	20	24
0124-RFJ	1	5	9	13	17	21
0125-EBH	2	6	10	14	18	22
0126-JBU	3	7	11	15	19	23

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0127-MZD	4	8	12	16	20	24
0129-OAY	1	5	9	13	17	21
0130-UZK	2	6	10	14	18	22
0131-PYH	3	7	11	15	19	23
0132-AKG	4	8	12	16	20	24
0133-LUA	1	5	9	13	17	21
0134-WFX	2	6	10	14	18	22
0135-YPU	3	7	11	15	19	23
0136-MTF	4	8	12	16	20	24
0137-LXU	1	5	9	13	17	21
0138-EXD	2	6	10	14	18	22
0139-CYT	3	7	11	15	19	23
0140-KDG	4	8	12	16	20	24
0141-ORK	1	5	9	13	17	21
0142-EGL	2	6	10	14	18	22
0143-SCB	3	7	11	15	19	23
0144-PNB	4	8	12	16	20	24
0145-WDD	1	5	9	13	17	21
0146-GOR	2	6	10	14	18	22
0147-XBY	3	7	11	15	19	23
0148-HLG	4	8	12	16	20	24
0149-OEW	1	5	9	13	17	21
0150-GTR	2	6	10	14	18	22
0151-EOB	3	7	11	15	19	23
0152-FNH	4	8	12	16	20	24
0153-GCE	1	5	9	13	17	21
0154-LLM	2	6	10	14	18	22
0155-HWS	3	7	11	15	19	23
0156-AKH	4	8	12	16	20	24
0157-FKW	1	5	9	13	17	21
0158-GEL	2	6	10	14	18	22
0159-SGB	3	7	11	15	19	23
0160-ZWX	4	8	12	16	20	24
0161-MFY	1	5	9	13	17	21
0162-CZR	2	6	10	14	18	22
0163-BAU	3	7	11	15	19	23
0164-AXC	4	8	12	16	20	24
0166-KEP	1	5	9	13	17	21
0167-DDR	2	6	10	14	18	22
0168-FNG	3	7	11	15	19	23
0169-KJW	4	8	12	16	20	24

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0170-XHH	1	5	9	13	17	21
0171-FTA	2	6	10	14	18	22
0172-NXG	3	7	11	15	19	23
0173-GOA	4	8	12	16	20	24
0174-CWX	1	5	9	13	17	21
0175-FXX	2	6	10	14	18	22
0176-NTD	3	7	11	15	19	23
0177-TZT	4	8	12	16	20	24
0178-RYW	1	5	9	13	17	21
0179-XUG	2	6	10	14	18	22
0180-DBF	3	7	11	15	19	23
0181-NGE	4	8	12	16	20	24
0182-TWZ	1	5	9	13	17	21
0183-HPP	2	6	10	14	18	22
0184-YDS	3	7	11	15	19	23
0185-SJO	4	8	12	16	20	24
0186-UJS	1	5	9	13	17	21
0187-BTR	2	6	10	14	18	22
0188-LHH	3	7	11	15	19	23
0189-SUB	4	8	12	16	20	24
0190-WMP	1	5	9	13	17	21
0191-AEB	2	6	10	14	18	22
0192-WWA	3	7	11	15	19	23
0193-LJP	4	8	12	16	20	24
0194-EHN	1	5	9	13	17	21
0195-RUR	2	6	10	14	18	22
0196-RLD	3	7	11	15	19	23
0197-XCT	4	8	12	16	20	24
0198-FRB	1	5	9	13	17	21
0199-XXD	2	6	10	14	18	22
0200-DMF	3	7	11	15	19	23
0201-KFX	4	8	12	16	20	24
0202-XXZ	1	5	9	13	17	21
0203-RGC	2	6	10	14	18	22
0204-KOP	3	7	11	15	19	23
0205-OAD	4	8	12	16	20	24
0206-PCL	1	5	9	13	17	21
0207-KYC	2	6	10	14	18	22
0208-NBM	3	7	11	15	19	23
0209-HTH	4	8	12	16	20	24
0210-SPX	1	5	9	13	17	21

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0211-RDU	2	6	10	14	18	22
0212-DAB	3	7	11	15	19	23
0213-TFY	4	8	12	16	20	24
0214-SDX	1	5	9	13	17	21
0215-KBE	2	6	10	14	18	22
0216-OFC	3	7	11	15	19	23
0217-ZSH	4	8	12	16	20	24
0218-YBO	1	5	9	13	17	21
0219-PFC	2	6	10	14	18	22
0220-RNM	3	7	11	15	19	23
0221-HAX	4	8	12	16	20	24
0222-PCY	1	5	9	13	17	21
0223-HPB	2	6	10	14	18	22
0224-FMZ	3	7	11	15	19	23
0225-XWP	4	8	12	16	20	24
0226-YDZ	1	5	9	13	17	21
0227-HWN	2	6	10	14	18	22
0228-UNB	3	7	11	15	19	23
0229-JKW	4	8	12	16	20	24
0230-MEZ	1	5	9	13	17	21
0231-CCM	2	6	10	14	18	22
0232-AMX	3	7	11	15	19	23
0233-AWM	4	8	12	16	20	24
0234-FNK	1	5	9	13	17	21
0235-EOU	2	6	10	14	18	22
0236-WZZ	3	7	11	15	19	23
0237-HXD	4	8	12	16	20	24
0238-FTG	1	5	9	13	17	21
0240-BJD	2	6	10	14	18	22
0241-EMA	3	7	11	15	19	23
0242-GZU	4	8	12	16	20	24
0243-MWC	1	5	9	13	17	21
0244-JUP	2	6	10	14	18	22
0245-LHU	3	7	11	15	19	23
0246-ZWP	4	8	12	16	20	24
0247-AUJ	1	5	9	13	17	21
0248-BBB	2	6	10	14	18	22
0249-HJT	3	7	11	15	19	23
0250-SGF	4	8	12	16	20	24
0251-GNF	1	5	9	13	17	21
0252-DSM	2	6	10	14	18	22

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0253-YPP	3	7	11	15	19	23
0254-DGX	4	8	12	16	20	24
0255-UJD	1	5	9	13	17	21
0256-JAD	2	6	10	14	18	22
0257-ARR	3	7	11	15	19	23
0259-ZHS	4	8	12	16	20	24
0260-AED	1	5	9	13	17	21
0261-SCB	2	6	10	14	18	22
0262-FOU	3	7	11	15	19	23
0263-AOP	4	8	12	16	20	24
0264-YKE	1	5	9	13	17	21
0265-EAJ	2	6	10	14	18	22
0266-LUG	3	7	11	15	19	23
0267-YLG	4	8	12	16	20	24
0268-ZUL	1	5	9	13	17	21
0269-GHF	2	6	10	14	18	22
0270-PRW	3	7	11	15	19	23
0271-UCR	4	8	12	16	20	24
0272-GSO	1	5	9	13	17	21
0273-KBW	2	6	10	14	18	22
0274-YBA	3	7	11	15	19	23
0275-PET	4	8	12	16	20	24
0276-TJN	1	5	9	13	17	21
0277-LFY	2	6	10	14	18	22
0278-WYF	3	7	11	15	19	23
0279-JAF	4	8	12	16	20	24
0280-TAW	1	5	9	13	17	21
0281-ASY	2	6	10	14	18	22
0282-ZMA	3	7	11	15	19	23
0283-EJG	4	8	12	16	20	24
0285-RPG	1	5	9	13	17	21
0286-NMK	2	6	10	14	18	22
0287-TEO	3	7	11	15	19	23
0289-ADJ	4	8	12	16	20	24
0290-EBL	1	5	9	13	17	21
0292-MLS	2	6	10	14	18	22
0293-DON	3	7	11	15	19	23
0294-WKS	4	8	12	16	20	24
0295-XXT	1	5	9	13	17	21
0296-SCH	2	6	10	14	18	22
0298-NNK	3	7	11	15	19	23

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0300-CSH	4	8	12	16	20	24
0301-ECY	1	5	9	13	17	21
0302-WJX	2	6	10	14	18	22
0303-ATZ	3	7	11	15	19	23
0304-FOE	4	8	12	16	20	24
0305-RNL	1	5	9	13	17	21
0306-FCG	2	6	10	14	18	22
0307-TSO	3	7	11	15	19	23
0308-PNK	4	8	12	16	20	24
0309-KWC	1	5	9	13	17	21
0310-WEL	2	6	10	14	18	22
0311-LON	3	7	11	15	19	23
0312-MHX	4	8	12	16	20	24
0313-YBP	1	5	9	13	17	21
0314-RSU	2	6	10	14	18	22
0315-GHG	3	7	11	15	19	23
0316-AEP	4	8	12	16	20	24
0317-OGC	1	5	9	13	17	21
0318-ZEW	2	6	10	14	18	22
0319-XRH	3	7	11	15	19	23
0320-MMP	4	8	12	16	20	24
0321-DFG	1	5	9	13	17	21
0322-UHW	2	6	10	14	18	22
0323-FAO	3	7	11	15	19	23
0324-WPN	4	8	12	16	20	24
0325-PSB	1	5	9	13	17	21
0326-ZKL	2	6	10	14	18	22
0327-XJC	3	7	11	15	19	23
0328-PUF	4	8	12	16	20	24
0329-FXR	1	5	9	13	17	21
0330-BOC	2	6	10	14	18	22
0331-PWJ	3	7	11	15	19	23
0332-DAO	4	8	12	16	20	24
0333-DKE	1	5	9	13	17	21
0334-ZNA	2	6	10	14	18	22
0335-PAO	3	7	11	15	19	23
0336-HTN	4	8	12	16	20	24
0337-SGD	1	5	9	13	17	21
0338-GKL	2	6	10	14	18	22
0339-PPW	3	7	11	15	19	23
0340-JAZ	4	8	12	16	20	24

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0341-MPM	1	5	9	13	17	21
0342-NMZ	2	6	10	14	18	22
0343-MLP	3	7	11	15	19	23
0344-XNF	4	8	12	16	20	24
0345-KZJ	1	5	9	13	17	21
0346-GEX	2	6	10	14	18	22
0347-XZN	3	7	11	15	19	23
0348-LPK	4	8	12	16	20	24
0349-MFZ	1	5	9	13	17	21
0350-TBP	2	6	10	14	18	22
0351-XPX	3	7	11	15	19	23
0352-GWW	4	8	12	16	20	24
0353-RZZ	1	5	9	13	17	21
0354-TCT	2	6	10	14	18	22
0355-YZN	3	7	11	15	19	23
0357-TJF	4	8	12	16	20	24
0358-GJG	1	5	9	13	17	21
0359-JYB	2	6	10	14	18	22
0360-XLD	3	7	11	15	19	23
0361-FZM	4	8	12	16	20	24
0362-PSX	1	5	9	13	17	21

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QUESTION 1

A small jewelry store sells watches and jewelry. The owner is interested in statistics and has estimated probabilities for the number of sold items on a typical day. To simplify matters, he assumes that he will sell at most 2 watches and at most 2 pieces of jewelry. The joint probabilities can be found in the table below.

		Jewelry		
		0	1	2
Watches	0	0,2	0,1	0,05
	1	0,1	0,2	0,1
	2	0,05	0,1	0,1

a. **Find the conditional probability that zero watches are sold given zero pieces of jewelry sold. (5p.)**
b. **Find the correlation between the number of watches sold and the number of pieces of jewelry sold. (5p.)**

The owner has also developed a model for the annual profit of the store, next year. He estimates that the profit will be normally distributed. If X is the profit in thousands of SEK, then

$$X \sim N(400, 100^2)$$

c. **Find the probability that profits will be more than 300, but less than 600, according to the owner's model. (5p.)**

Remember to include calculations. Show your work!

QUESTION 2

A small jewelry store sells watches and jewelry. The owner is interested in statistics and has estimated probabilities for the number of sold items on a typical day. To simplify matters, he assumes that he will sell at most 2 watches and at most 2 pieces of jewelry. The joint probabilities can be found in the table below.

		Jewelry		
		0	1	2
Watches	0	0,3	0,1	0,05
	1	0,1	0,1	0,1
	2	0,05	0,1	0,1

a. **Find the conditional probability that zero watches are sold given zero pieces of jewelry sold. (5p.)**
b. **Find the correlation between the number of watches sold and the number of pieces of jewelry sold. (5p.)**

The owner has also developed a model for the annual profit of the store, next year. He estimates that the profit will be normally distributed. If X is the profit in thousands of SEK, then

$$X \sim N(500, 100^2)$$

c. **Find the probability that profits will be more than 300, but less than 600, according to the owner's model. (5p.)**

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QUESTION 3

A small jewelry store sells watches and jewelry. The owner is interested in statistics and has estimated probabilities for the number of sold items on a typical day. To simplify matters, he assumes that he will sell at most 2 watches and at most 2 pieces of jewelry. The joint probabilities can be found in the table below.

		Jewelry		
		0	1	2
Watches	0	0,3	0,1	0,05
	1	0,1	0,1	0,1
	2	0,05	0,1	0,1

a. **Find the conditional probability that zero watches are sold given zero pieces of jewelry sold. (5p.)**
b. **Find the correlation between the number of watches sold and the number of pieces of jewelry sold. (5p.)**

The owner has also developed a model for the annual profit of the store, next year. He estimates that the profit will be normally distributed. If X is the profit in thousands of SEK, then

$$X \sim N(400, 100^2)$$

c. **Find the probability that profits will be more than 300, but less than 600, according to the owner's model. (5p.)**

Remember to include calculations. Show your work!

QUESTION 4

A small jewelry store sells watches and jewelry. The owner is interested in statistics and has estimated probabilities for the number of sold items on a typical day. To simplify matters, he assumes that he will sell at most 2 watches and at most 2 pieces of jewelry. The joint probabilities can be found in the table below.

		Jewelry		
		0	1	2
Watches	0	0,2	0,15	0,05
	1	0,15	0,1	0,1
	2	0,05	0,1	0,1

a. **Find the conditional probability that zero watches are sold given zero pieces of jewelry sold. (5p.)**
b. **Find the correlation between the number of watches sold and the number of pieces of jewelry sold. (5p.)**

The owner has also developed a model for the annual profit of the store, next year. He estimates that the profit will be normally distributed. If X is the profit in thousands of SEK, then

$$X \sim N(400, 100^2)$$

c. **Find the probability that profits will be more than 300, but less than 500, according to the owner's model. (5p.)**

Remember to include calculations. Show your work!

QUESTION 5

a. Suppose that 90% of all Swedes are right-handed and that we draw a simple random sample of 18 Swedes. **Find the probability that <u>at most</u> 16 of the Swedes in our sample are right-handed. (5p.)**

b. A television production company has produced a new reality TV-show. They show the first "pilot episode" to a random sample of 16 potential viewers, to find out if the show will be a success or not. Suppose that a randomly selected viewer has a 20% probability of liking the episode. **What is the probability that <u>at most</u> 4 viewers in the sample like the show? (5p.)**

c. You decide to flip a coin 50 times for some reason. Each time, the coin will come up heads with probability 0.5 and tails with probability 0.5. **Find the probability that your coin will come up heads exactly 25 times**. **(5p.)**

For part c, you can choose between two types of solutions:

First alternative: find the probability exactly using the relevant probability function. It is OK to round your final answer.

Second alternative: use the approximation method taught in class. Hint for this alternative: Can you find the approximate probability of 24 heads or fewer? Can you also find the approximate probability of 25 heads or fewer?

Remember to include calculations. Show your work!

QUESTION 6

a. Suppose that 90% of all Swedes are right-handed and that we draw a simple random sample of 16 Swedes. **Find the probability that <u>at least</u> 13 of the Swedes in our sample are right-handed. (5p.)**

b. A television production company has produced a new reality TV-show. They show the first "pilot episode" to a random sample of 15 potential viewers, to find out if the show will be a success or not. Suppose that a randomly selected viewer has a 25% probability of liking the episode. **What is the probability that <u>at least</u> 3 viewers in the sample like the show? (5p.)**

c. You decide to flip a coin 40 times for some reason. Each time, the coin will come up heads with probability 0.5 and tails with probability 0.5. **Find the probability that your coin will come up heads exactly 20 times**. **(5p.)**

For part c, you can choose between two types of solutions:

First alternative: find the probability exactly using the relevant probability function. It is OK to round your final answer.

Second alternative: use the approximation method taught in class. Hint for this alternative: Can you find the approximate probability of 19 heads or fewer? Can you also find the approximate probability of 20 heads or fewer?

Remember to include calculations. Show your work!

QUESTION 7

a. Suppose that 90% of all Swedes are right-handed and that we draw a simple random sample of 15 Swedes. **Find the probability that <u>at most</u> 11 of the Swedes in our sample are right-handed. (5p.)**

b. A television production company has produced a new reality TV-show. They show the first "pilot episode" to a random sample of 12 potential viewers, to find out if the show will be a success or not. Suppose that a randomly selected viewer has a 30% probability of liking the episode. **What is the probability that <u>at most</u> 5 viewers in the sample like the show? (5p.)**

c. You decide to flip a coin 60 times for some reason. Each time, the coin will come up heads with probability 0.5 and tails with probability 0.5. **Find the probability that your coin will come up heads exactly 30 times**. **(5p.)**

For part c, you can choose between two types of solutions:

First alternative: find the probability exactly using the relevant probability function. It is OK to round your final answer.

Second alternative: use the approximation method taught in class. Hint for this alternative: Can you find the approximate probability of 29 heads or fewer? Can you also find the approximate probability of 30 heads or fewer?

Remember to include calculations. Show your work!

QUESTION 8

a. Suppose that 90% of all Swedes are right-handed and that we draw a simple random sample of 12 Swedes. **Find the probability that <u>at least</u> 10 of the Swedes in our sample are right-handed. (5p.)**

b. A television production company has produced a new reality TV-show. They show the first "pilot episode" to a random sample of 18 potential viewers, to find out if the show will be a success or not. Suppose that a randomly selected viewer has a 15% probability of liking the episode. **What is the probability that <u>at least</u> 3 viewers in the sample like the show? (5p.)**

c. You decide to flip a coin 50 times for some reason. Each time, the coin will come up heads with probability 0.5 and tails with probability 0.5. **Find the probability that your coin will come up heads exactly 25 times**. **(5p.)**

For part c, you can choose between two types of solutions:

First alternative: find the probability exactly using the relevant probability function. It is OK to round your final answer.

Second alternative: use the approximation method taught in class. Hint for this alternative: Can you find the approximate probability of 24 heads or fewer? Can you also find the approximate probability of 25 heads or fewer?

Remember to include calculations. Show your work!

QUESTION 9

A Swedish survey of drug use among second-year high-school students included the question

"have you used cannabis in the last 12 months?"

In 2018, 13% of the random sample of 200 students answered "Yes."

In 2019, the survey was repeated and this time, 11% of 200 students answered "Yes."

a. **Assuming that both samples were representative, find a 90% confidence interval for the change in proportion of students who have used cannabis in the last 12 months. (5p.)**
b. **In a larger survey the proportion of students who answered "Yes" to the same question was 12% and the 95% margin of error was less than 1%. Find the minimum sample size that could have been used. (5p.)**

Remember to include calculations. Show your work!

QUESTION 10

A Swedish survey of drug use among second-year high-school students included the question

"have you used cannabis in the last 12 months?"

In 2018, 13% of the random sample of 400 students answered "Yes."

In 2019, the survey was repeated and this time, 11% of 400 students answered "Yes."

a. **Assuming that both samples were representative, find a 99% confidence interval for the change in proportion of students who have used cannabis in the last 12 months. (5p.)**
b. **In a larger survey the proportion of students who answered "Yes" to the same question was 11% and the 95% margin of error was less than 1%. Find the minimum sample size that could have been used. (5p.)**

Remember to include calculations. Show your work!

QUESTION 11

A Swedish survey of drug use among second-year high-school students included the question

"have you used cannabis in the last 12 months?"

In 2018, 11% of the random sample of 400 students answered "Yes."

In 2019, the survey was repeated and this time, 12% of 400 students answered "Yes."

a. **Assuming that both samples were representative, find a 90% confidence interval for the change in proportion of students who have used cannabis in the last 12 months. (5p.)**
b. **In a larger survey the proportion of students who answered "Yes" to the same question was 11% and the 95% margin of error was less than 2%. Find the minimum sample size that could have been used. (5p.)**

Remember to include calculations. Show your work!

QUESTION 12

A Swedish survey of drug use among second-year high-school students included the question

"have you used cannabis in the last 12 months?"

In 2018, 11% of the random sample of 300 students answered "Yes."

In 2019, the survey was repeated and this time, 12% of 300 students answered "Yes."

a. **Assuming that both samples were representative, find a 99% confidence interval for the change in proportion of students who have used cannabis in the last 12 months. (5p.)**
b. **In a larger survey the proportion of students who answered "Yes" to the same question was 12% and the 95% margin of error was less than 2%. Find the minimum sample size that could have been used. (5p.)**

Remember to include calculations. Show your work!

QUESTION 13

A group of scientists wanted to research the effect of access to exercise equipment on mice.

They assigned one random sample of lab mice to cages with a hamster wheel (a type of exercise equipment, see Figure 1).

Another randomly chosen group of mice were assigned to the control group; they were placed in cages without any exercise equipment.

After three weeks, the scientists measured VO2-max of each mouse (a measure of their physical fitness).

The results are presented in the table below. **By answering the questions, test at the 5% level of significance whether access to a hamster wheel <u>improves</u> the VO2-max in mice.**

The standard deviation for each group was calculated from the sample. You should assume that the population variances are equal for the two groups and that VO2-max is normally distributed.

mean, VO2-max		standard deviation		sample size	
treatment	control	treatment	control	treatment	control
76	74	2,8	2,6	8	8

a) State the hypotheses and the decision rule (5 p.)
b) Calculate the test variable and state the outcome of the test (5p.)

Figure 1:hamster wheel. Image by Annalise Batista

Remember to include calculations. Show your work!

QUESTION 14

A group of scientists wanted to research the effect of access to exercise equipment on mice.

They assigned one random sample of lab mice to cages with a hamster wheel (a type of exercise equipment, see Figure 2).

Another randomly chosen group of mice were assigned to the control group; they were placed in cages without any exercise equipment.

After three weeks, the scientists measured VO2-max of each mouse (a measure of their physical fitness).

The results are presented in the table below. **By answering the questions, test at the 5% level of significance whether access to a hamster wheel <u>improves</u> the VO2-max in mice.**

The standard deviation for each group was calculated from the sample. You should assume that the population variances are equal for the two groups and that VO2-max is normally distributed.

mean, VO2-max		standard deviation		sample sizes	
treatment	control	treatment	control	treatment	control
76	75	3,2	2,8	6	6

a) State the hypotheses and the decision rule (5 p.)
b) Calculate the test variable and state the outcome of the test (5p.)

Figure 2:hamster wheel. Image by Annalise Batista

Remember to include calculations. Show your work!

QUESTION 15

A group of scientists wanted to research the effect of access to exercise equipment on mice.

They assigned one random sample of lab mice to cages with a hamster wheel (a type of exercise equipment, see Figure 3).

Another randomly chosen group of mice were assigned to the control group; they were placed in cages without any exercise equipment.

After three weeks, the scientists measured VO2-max of each mouse (a measure of their physical fitness).

The results are presented in the table below. **By answering the questions, test at the 5% level of significance whether access to a hamster wheel <u>improves</u> the VO2-max in mice.**

The standard deviation for each group was calculated from the sample. You should assume that the population variances are equal for the two groups and that VO2-max is normally distributed.

mean, VO2-max		standard deviation		sample sizes	
treatment	control	treatment	control	treatment	control
83	80	3,3	3,7	10	10

a) State the hypotheses and the decision rule (5 p.)
b) Calculate the test variable and state the outcome of the test (5p.)

Figure 3:hamster wheel. Image by Annalise Batista

Remember to include calculations. Show your work!

QUESTION 16

A group of scientists wanted to research the effect of access to exercise equipment on mice.

They assigned one random sample of lab mice to cages with a hamster wheel (a type of exercise equipment, see Figure 4).

Another randomly chosen group of mice were assigned to the control group; they were placed in cages without any exercise equipment.

After three weeks, the scientists measured VO2-max of each mouse (a measure of their physical fitness).

The results are presented in the table below. **By answering the questions, test at the 5% level of significance whether access to a hamster wheel <u>improves</u> the VO2-max in mice.**

The standard deviation for each group was calculated from the sample. You should assume that the population variances are equal for the two groups and that VO2-max is normally distributed.

mean, VO2-max		standard deviation		sample sizes	
treatment	control	treatment	control	treatment	control
83	79	3,3	3,7	8	8

a) State the hypotheses and the decision rule (5 p.)
b) Calculate the test variable and state the outcome of the test (5p.)

Figure 4:hamster wheel. Image by Annalise Batista

Remember to include calculations. Show your work!

QUESTION 17

A website developer creates three versions of the same website, a "light theme" version, a "dark theme" version, and a "blue theme" version. Every unique visitor sees one of the three versions and which one they see is randomly assigned. After some time on the website, the visitors rate their user experience on a scale from 1-5 where:

1 = very bad

2 = bad

3 = neither good nor bad

4 = good

5 = very good

The table below shows the distribution of website versions and ratings for the 240 visitors in the sample. Regard the sample as random, independent, and identically distributed.

	light	**dark**	**blue**
1	12	9	9
2	20	12	28
3	30	34	26
4	11	18	10
5	7	7	7

Test at a 5% significance level whether visitor user experience is independent of website version.

a. **State the hypotheses, test variable, critical value and decision rule. (5p.)**
b. **Calculate the test variable and interpret the outcome of the test. Remember to show your calculations. (5p.)**
c. **Before the study started, the developer worried that the study would result in a Type-2 error. Someone suggested that this would be less likely to happen with a 1% significance level instead of 5%. Does this make sense? Explain. (5p.)**
d. **Make a table of the conditional relative frequencies of user ratings. Condition on website version. (5p)**

Remember to include calculations. Show your work!

QUESTION 18

The owner of fast food restaurant chain wants to investigate whether the toy included with the “Kid's Value Meal” affects how the kids rate the food. A random sample of kids are given a value meal and each box also contains a cheap toy. Which toy the kid gets is also random and there are three kinds: "Gumball," "Teen Titans," and "Unkitty."

After eating the meal and getting the toy, the kids rate food on a scale from A-E where:

A = delicious

B = good

C = neither good nor bad

D = bad

E = disgusting

The table below shows the distribution of toys and ratings for the 480 children in the sample. Regard the sample as random, independent, and identically distributed.

	E	D	C	B	A
Gumball	18	40	60	28	14
Teen Titans	18	24	64	36	18
Unkitty	18	56	56	20	10

Test at a 5% significance level whether the toy type is independent of food rating.

a. **State the hypotheses, test variable, critical value and decision rule. (5p.)**
b. **Calculate the test variable and interpret the outcome of the test. Remember to show your calculations. (5p.)**
c. **Before the study started, the owner worried that the study would result in a Type-1 error. Someone suggested that this would be less likely to happen with a 1% significance level instead of 5%. Does this make sense? Explain. (5p.)**
d. **Make a table of the conditional relative frequencies of food ratings. Condition on toy type. (5p.)**

Remember to include calculations. Show your work!

QUESTION 19

A website developer creates three versions of the same website, a "light theme" version, a "dark theme" version, and a "blue theme" version. Every unique visitor sees one of the three versions and which one they see is randomly assigned. After some time on the website, the visitors rate their user experience on a scale from 1-5 where:

1 = very bad

2 = bad

3 = neither good nor bad

4 = good

5 = very good

The table below shows the distribution of website versions and ratings for the 720 visitors in the sample. Regard the sample as random, independent, and identically distributed.

	light	**dark**	**blue**
1	42	27	27
2	60	60	60
3	90	84	96
4	27	42	42
5	21	27	15

Test at a 5% significance level whether visitor user experience is independent of website version.

a. **State the hypotheses, test variable, critical value and decision rule. (5p.)**
b. **Calculate the test variable and interpret the outcome of the test. Remember to show your calculations. (5p.)**
c. **Before the study started, the developer worried that the study would result in a Type-2 error. Someone suggested that this would be less likely to happen with a 1% significance level instead of 5%. Does this make sense? Explain. (5p.)**
d. **Make a table of the conditional relative frequencies of user ratings. Condition on website version. (5p.)**

Remember to include calculations. Show your work!

QUESTION 20

The owner of fast food restaurant chain wants to investigate whether the toy included with the “Kid's Value Meal” affects how the kids rate the food. A random sample of kids are given a value meal in a box and each box also contains a cheap toy. Which toy the kid gets is also random and there are three kinds: "Gumball," "Teen Titans," and "Unkitty."

After eating the meal and getting the toy, the kids rate food on a scale from A-E where:

A = delicious

B = good

C = neither good nor bad

D = bad

E = disgusting

The table below shows the distribution of toys and ratings for the 480 children in the sample. Regard the sample as random, independent, and identically distributed.

	E	D	C	B	A
Gumball	20	40	60	26	14
Teen Titans	16	28	68	30	18
Unkitty	18	52	52	28	10

Test at a 5% significance level whether the toy type is independent of food rating.

a. **State the hypotheses, test variable, critical value and decision rule. (5p.)**
b. **Calculate the test variable and interpret the outcome of the test. Remember to show your calculations. (5p.)**
c. **Before the study started, the owner worried that the study would result in a Type-1 error. Someone suggested that this would be less likely to happen with a 1% significance level instead of 5%. Does this make sense? Explain. (5p.)**
d. **Make a table of the conditional relative frequencies of food ratings. Condition on toy type. (5p)**

Remember to include calculations. Show your work!

QUESTION 21

A trucking company wants to investigate how the weight of the cargo transported affects fuel consumption. Initially, a business analyst estimated the following model using a random sample of deliveries.

Y = gasoline consumption (liters/100km)

x1 = cargo weight (1000s kg)

MODEL 1: $Y = \beta_0 + \beta_1 x_1 + \varepsilon$

The estimated models 1, 2, and 3 can be found on the following pages. In each model these models, $\varepsilon \sim N(0, \sigma^2)$.

a. **Use the estimated MODEL 1 to find a 95% prediction interval for the fuel consumption of a truck given a cargo weight of 18. Interpret the result (5p.)**
b. **Find the coefficient of determination of MODEL 1. Interpret the result. (5p.)**

The analysts expanded the model to include a second variable x_2, a dummy variable where $x_2 = 0$ if the route is <u>not</u> hilly (mostly flat) and $x_2 = 1$ if the route is hilly.

MODEL 2: $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$

c. **Test at the 5% level of significance whether $\boldsymbol{\beta_2 > 0}$, given that cargo weight is included in the model. Clearly state hypotheses, test variable, critical value and decision rule, calculations, and conclusion. (10p.)**

Still not happy, the analyst adds a new variable to the model. The new variable is the product $x_1 \cdot x_2$

MODEL 3: $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 \cdot x_1 \cdot x_2 + \varepsilon$

d. **Explain why one might include this new term. What is the interpretation of β_3 ? (5p.)**
e. **Finally, the analyst considers to include a fourth variable x_4. She decides against including x_4 in her model after studying the scatter plots in the figure "scatter plots" below. Explain why. (5p.)**

Mean and variance of x_1:
$\bar{x}_1 = 15{,}5$; $s_x^2 = 7{,}8$

MODEL 1

Regression Statistics	
Multiple R	0,545660819
R Square	
Adjusted R Square	
Standard Error	8,434230798
Observations	34

Remember to include calculations. Show your work!

ANOVA

	df	*SS*	*MS*
Regression	1	965,1439479	965,1439479
Residual	32	2276,359973	71,13624915
Total	33	3241,503921	

	Coefficients	*Standard Error*
Intercept	7,921004971	7,820576396
x1	1,824624799	0,495362365

MODEL 2

Regression Statistics	
Multiple R	0,974633432
R Square	0,949910326
Adjusted R Square	0,946678734
Standard Error	2,28858228
Observations	34

ANOVA

	df	*SS*	*MS*
Regression	2	3079,138046	1539,569023
Residual	31	162,3658744	5,237608852
Total	33	3241,503921	

	Coefficients	*Standard Error*
Intercept	-8,206730539	2,268835338
x1	2,014963215	0,134747342
x2	17,91745128	0,891848072

MODEL 3

Regression Statistics	
Multiple R	0,979923362
R Square	0,960249795
Adjusted R Square	0,956274774
Standard Error	2,072441759
Observations	34

Remember to include calculations. Show your work!

ANOVA

	df	*SS*	*MS*
Regression	3	3112,653475	1037,551158
Residual	30	128,8504454	4,295014845
Total	33	3241,503921	

	Coefficients	*Standard Error*
Intercept	6,337581767	5,597299764
x1	1,097768075	0,350278935
x2	1,423357474	5,959548326
x1*x2	1,043869986	0,373685592

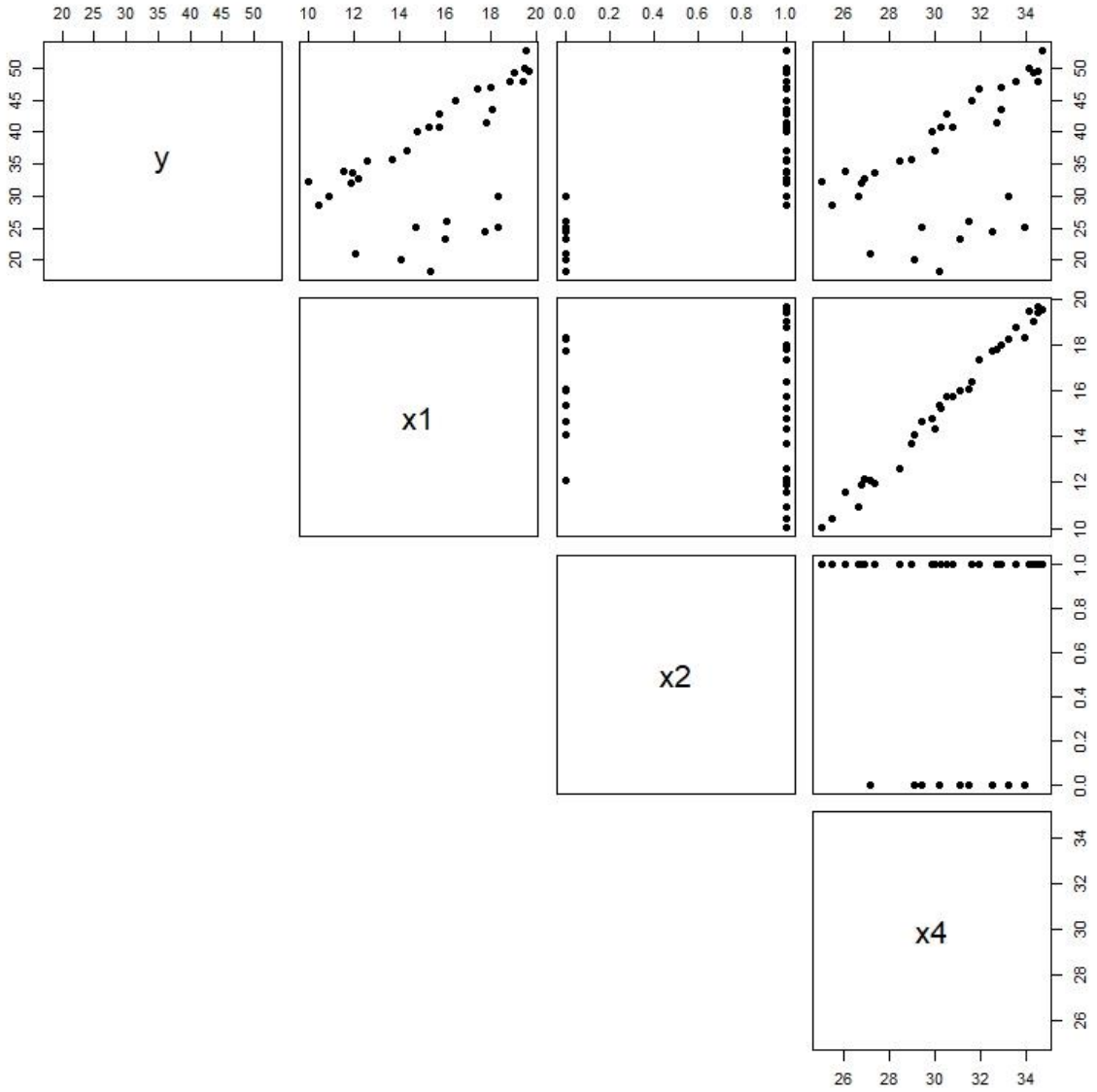

Figure: scatter plots

Remember to include calculations. Show your work!

END OF QUESTION 21

Remember to include calculations. Show your work!

QUESTION 22

A trucking company wants to investigate how the weight of the cargo transported affects fuel consumption. Initially, a business analyst estimated the following model using a random sample of deliveries.

Y = gasoline consumption (liters/100km)

x1 = cargo weight (1000s kg)

MODEL 1: $Y = \beta_0 + \beta_1 x_1 + \varepsilon$

The estimated models 1, 2, and 3 can be found on the following pages. In each model these models, $\varepsilon \sim N(0, \sigma^2)$.

a. **Use the estimated MODEL 1 to find a 95% confidence interval for the mean fuel consumption given a cargo weight of 18. Interpret the result (5p.)**
b. **Find the coefficient of determination of MODEL 1. Interpret the result. (5p.)**

The analysts expanded the model to include a second variable x_2, a dummy variable where $x_2 = 0$ if the route is <u>not</u> hilly (mostly flat) and $x_2 = 1$ if the route is hilly.

MODEL 2: $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$

c. **Test at the 5% level of significance whether $\boldsymbol{\beta_2 \neq 0}$, given that cargo weight is included in the model. Clearly state hypotheses, test variable, critical value and decision rule, calculations, and conclusion. (10p.)**

Still not happy, the analyst adds a new variable to the model. The new variable is the product $x_1 \cdot x_2$

MODEL 3: $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 \cdot x_1 \cdot x_2 + \varepsilon$

d. **Explain why one might include this new term. What is the interpretation of β_3 ? (5p.)**
e. **Finally, the analyst considers to include a fourth variable x_4. She decides against including x_4 in her model after studying the scatter plots in the figure "scatter plots" below. Explain why. (5p.)**

Mean and variance of x_1:
$\bar{x}_1 = 15{,}7$; $s_x^2 = 8{,}4$

MODEL 1

Regression Statistics	
Multiple R	0,817904271
R Square	
Adjusted R Square	
Standard Error	2,932859288
Observations	24

Remember to include calculations. Show your work!

ANOVA

	df	*SS*	*MS*
Regression	1	382,4188728	382,4188728
Residual	22	189,2365993	8,601663604
Total	23	571,6554721	

	Coefficients	*Standard Error*
Intercept	9,610424653	3,373510731
x1	1,407237759	0,211051794

MODEL 2

Regression Statistics	
Multiple R	0,828356938
R Square	0,686175217
Adjusted R Square	0,656287143
Standard Error	2,922813829
Observations	24

ANOVA

	df	*SS*	*MS*
Regression	2	392,2558178	196,1279089
Residual	21	179,3996542	8,542840677
Total	23	571,6554721	

	Coefficients	*Standard Error*
Intercept	7,258373835	4,013366057
x1	1,504336155	0,228967315
x2	1,413664142	1,317398827

MODEL 3

Regression Statistics	
Multiple R	0,832508332
R Square	0,693070122
Adjusted R Square	0,647030641
Standard Error	2,961909385
Observations	24

Remember to include calculations. Show your work!

ANOVA

	df	*SS*	*MS*
Regression	3	396,197328	132,065776
Residual	20	175,4581441	8,772907203
Total	23	571,6554721	

	Coefficients	*Standard Error*
Intercept	10,85906012	6,737796717
x1	1,293238378	0,391182076
x2	-3,88093383	8,011046068
x1*x2	0,325681694	0,485885335

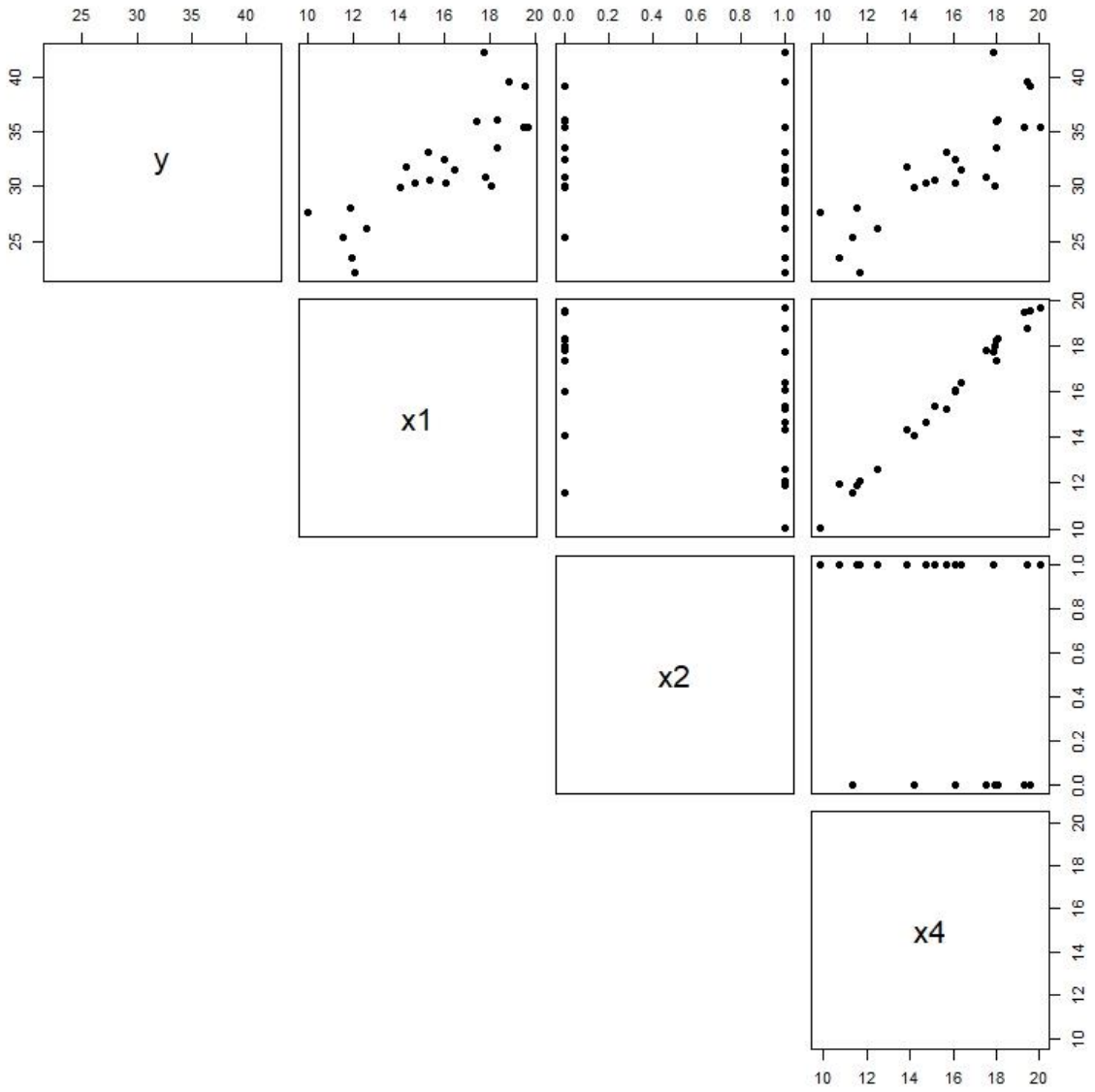

Figure: scatter plots

Remember to include calculations. Show your work!

END OF QUESTION 22

Remember to include calculations. Show your work!

QUESTION 23

A trucking company wants to investigate how the weight of the cargo transported affects fuel consumption. Initially, a business analyst estimated the following model using a random sample of deliveries.

Y = gasoline consumption (liters/100km)

x1 = cargo weight (1000s kg)

MODEL 1: $Y = \beta_0 + \beta_1 x_1 + \varepsilon$

The estimated models 1, 2, and 3 can be found on the following pages. In each model these models, $\varepsilon \sim N(0, \sigma^2)$.

a. **Use the estimated MODEL 1 to find a 95% prediction interval for the fuel consumption of a truck given a cargo weight of 15. Interpret the result (5p.)**
b. **Find the coefficient of determination of MODEL 1. Interpret the result. (5p.)**

The analysts expanded the model to include a second variable x_2, a dummy variable where $x_2 = 0$ if the route is <u>not</u> hilly (mostly flat) and $x_2 = 1$ if the route is hilly.

MODEL 2: $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$

c. **Test at the 5% level of significance whether $\boldsymbol{\beta_2 > 0}$, given that cargo weight is included in the model. Clearly state hypotheses, test variable, critical value and decision rule, calculations, and conclusion. (10p.)**

Still not happy, the analyst adds a new variable to the model. The new variable is the product $x_1 \cdot x_2$

MODEL 3: $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 \cdot x_1 \cdot x_2 + \varepsilon$

d. **Explain why one might include this new term. What is the interpretation of β_3 ? (5p.)**
e. **Finally, the analyst considers to include a fourth variable x_4. She decides against including x_4 in her model after studying the scatter plots in the figure "scatter plots" below. Explain why. (5p.)**

Mean and variance of x_1:
$\bar{x}_1 = 15{,}5$; $s_x^2 = 7{,}9$

MODEL 1

Regression Statistics	
Multiple R	0,669553077
R Square	
Adjusted R Square	
Standard Error	8,259844311
Observations	54

Remember to include calculations. Show your work!

ANOVA

	df	*SS*	*MS*
Regression	1	2882,804188	2882,804188
Residual	52	3547,701458	68,22502804
Total	53	6430,505647	

	Coefficients	*Standard Error*
Intercept	2,459411458	6,345573401
x1	2,621229796	0,403245366

MODEL 2

Regression Statistics	
Multiple R	0,902700927
R Square	0,814868963
Adjusted R Square	0,807608922
Standard Error	4,831445567
Observations	54

ANOVA

	df	*SS*	*MS*
Regression	2	5240,019467	2620,009733
Residual	51	1190,48618	23,34286627
Total	53	6430,505647	

	Coefficients	*Standard Error*
	-	
Intercept	2,656531445	3,746479014
x1	2,255543873	0,238661685
x2	14,92542337	1,485265613

MODEL 3

Regression Statistics	
Multiple R	0,906264845
R Square	0,821315969
Adjusted R Square	0,810594927
Standard Error	4,793805731
Observations	54

Remember to include calculations. Show your work!

ANOVA

	df	*SS*	*MS*
Regression	3	5281,476977	1760,492326
Residual	50	1149,028669	22,98057338
Total	53	6430,505647	

	Coefficients	*Standard Error*
Intercept	4,793488096	6,677151992
x1	1,752235309	0,443276993
x2	4,30956887	8,039975554
x1*x2	0,704301191	0,524369281

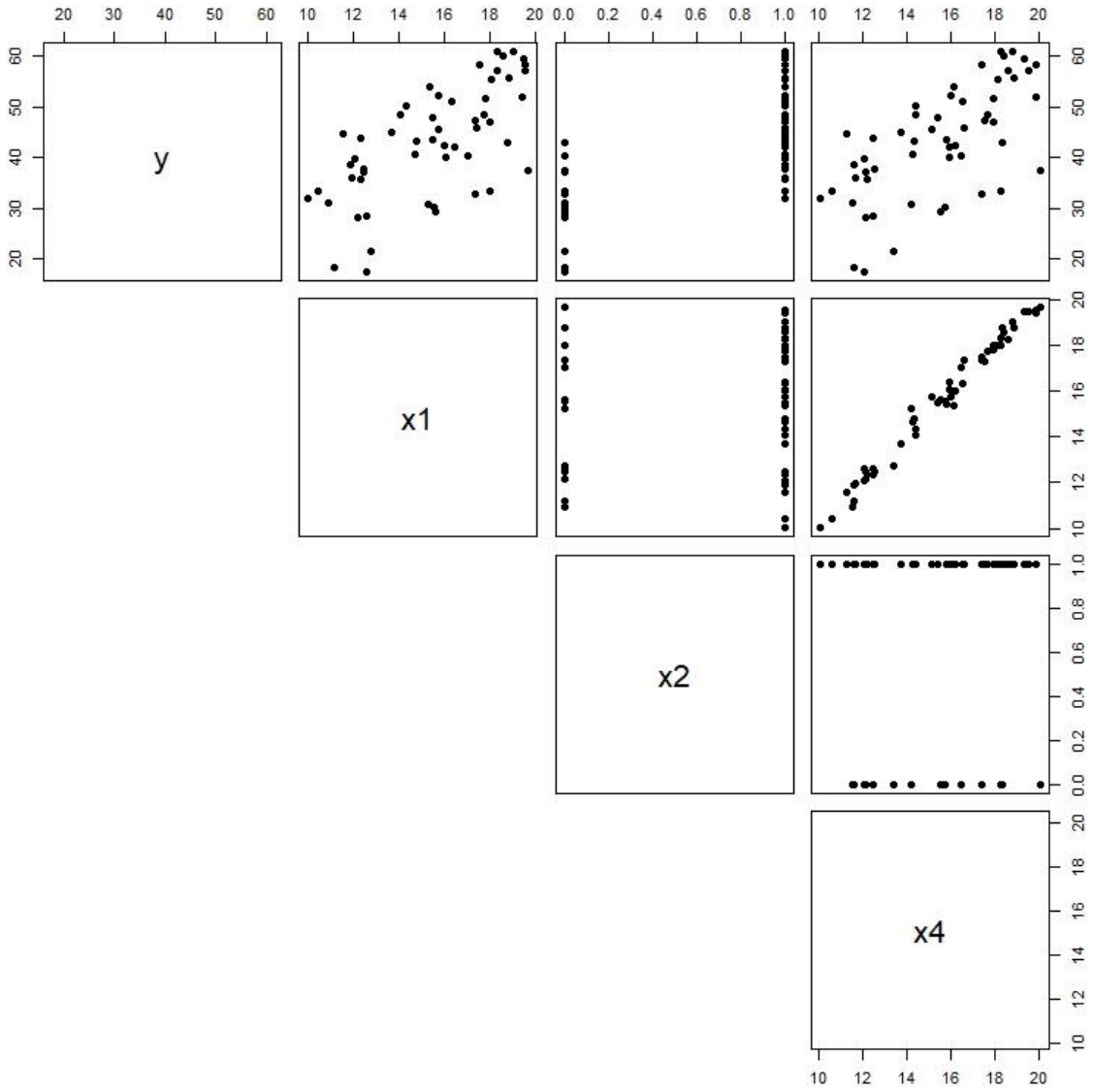

Figure: scatter plots

Remember to include calculations. Show your work!

END OF QUESTION 23

Remember to include calculations. Show your work!

QUESTION 24

A trucking company wants to investigate how the weight of the cargo transported affects fuel consumption. Initially, a business analyst estimated the following model using a random sample of deliveries.

Y = gasoline consumption (liters/100km)

x1 = cargo weight (1000s kg)

MODEL 1: $Y = \beta_0 + \beta_1 x_1 + \varepsilon$

The estimated models 1, 2, and 3 can be found on the following pages. In each model these models, $\varepsilon \sim N(0, \sigma^2)$.

a. **Use the estimated MODEL 1 to find a 95% confidence interval for the mean fuel consumption given a cargo weight of 18. Interpret the result (5p.)**
b. **Find the coefficient of determination of MODEL 1. Interpret the result. (5p.)**

The analysts expanded the model to include a second variable x_2, a dummy variable where $x_2 = 0$ if the route is <u>not</u> hilly (mostly flat) and $x_2 = 1$ if the route is hilly.

MODEL 2: $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$

c. **Test at the 5% level of significance whether $\boldsymbol{\beta_2 > 0}$, given that cargo weight is included in the model. Clearly state hypotheses, test variable, critical value and decision rule, calculations, and conclusion. (10p.)**

Still not happy, the analyst adds a new variable to the model. The new variable is the product $x_1 \cdot x_2$

MODEL 3: $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 \cdot x_1 \cdot x_2 + \varepsilon$

d. **Explain why one might include this new term. What is the interpretation of β_3 ? (5p.)**
e. **Finally, the analyst considers to include a fourth variable x_4. She decides against including x_4 in her model after studying the scatter plots in the figure "scatter plots" below. Explain why. (5p.)**

Mean and variance of x_1:

$\bar{x}_1 = 15{,}1$; $s_x^2 = 6{,}7$

MODEL 1

Regression Statistics	
Multiple R	0,765956344
R Square	
Adjusted R Square	
Standard Error	4,605790695
Observations	28

Remember to include calculations. Show your work!

ANOVA

	df	*SS*	*MS*
Regression	1	782,9119843	782,9119843
Residual	26	551,5460061	21,21330793
Total	27	1334,45799	

	Coefficients	*Standard Error*
Intercept	0,946997224	5,240604799
x1	2,07271215	0,341182479

MODEL 2

Regression Statistics	
Multiple R	0,795558483
R Square	0,632913299
Adjusted R Square	0,603546363
Standard Error	4,42656427
Observations	28

ANOVA

	df	*SS*	*MS*
Regression	2	844,5962096	422,2981048
Residual	25	489,8617809	19,59447123
Total	27	1334,45799	

	Coefficients	*Standard Error*
Intercept	-1,92153	5,28979
x1	2,12999	0,32949
x2	3,11261	1,75430

MODEL 3

Regression Statistics	
Multiple R	0,81043419
R Square	0,656803577
Adjusted R Square	0,613904024
Standard Error	4,36835786
Observations	28

Remember to include calculations. Show your work!

ANOVA

	df	*SS*	*MS*
Regression	3	876,476781	292,158927
Residual	24	457,9812095	19,08255039
Total	27	1334,45799	

	Coefficients	*Standard Error*
Intercept	13,65022	13,12974
x1	1,12420	0,84335
x2	-15,08649	14,18611
x1*x2	1,18141	0,91402

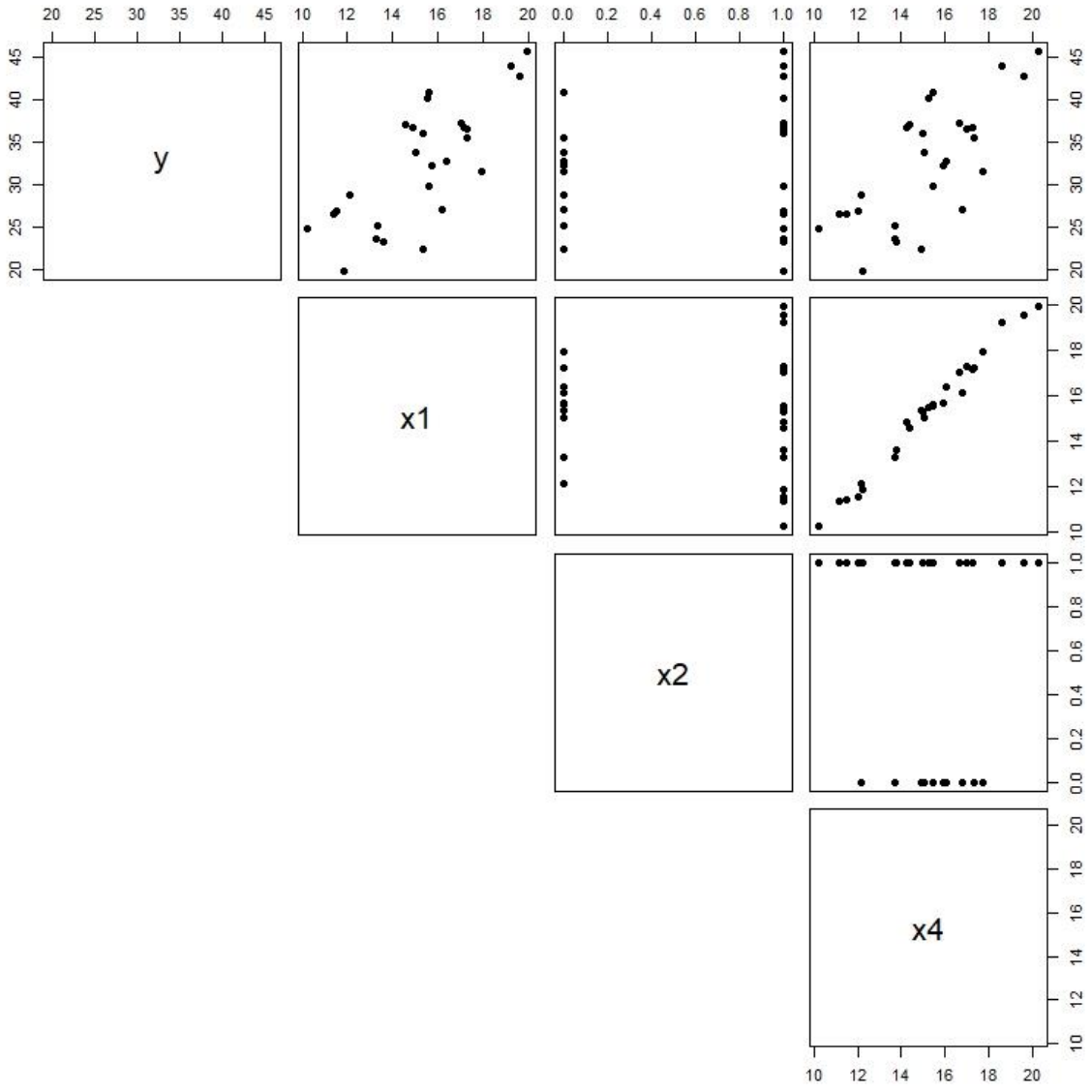

Figure: scatter plots

Remember to include calculations. Show your work!

END OF QUESTION 24

END OF EXAM