Stockholm University

STOCKHOLM UNIVERSITY
Department of Statistics
Spring 2021

Ulf Högnäs (examiner)

EXAM – BASIC STATISTICS FOR ECONOMISTS

2021-06-04

Time: 13.00-19.00 (including one extra hour to arrange the electronic submission).

Approved aid: Any books, notes, or digital resources. You are not allowed to communicate with anyone during the exam. This includes chats, messages, and internet forums.

- **Problems 1 – 20 MULTIPLE CHOICE QUESTIONS – max 50 points**
  - A total of 10 multiple choice questions with five alternative answers per question one of which is the correct answer. Mark your answers on the attached answer form or on one page. If you prefer, you can make a handwritten version, but please make it clear.
  - Mark exactly one answer and do not provide written solution for these problems.
- **Problems 21 – 22**: **COMPLETE 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).

  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.

  Follow the instructions carefully when you submit your answers. The instructions were sent out in a separate email.

  NOTE! If the course coordinator needs to send out information to all students during the exam, this is done to your registered email address. Therefore, check your email during the exam.

  GOOD LUCK!

Do all the problems listed on the row of your anonymity code.

Code							
0001-RYG	1	5	9	13	17	21	22
0002-SJP	2	6	10	14	18	21	22
0003-EYZ	3	7	11	15	19	21	22
0004-MYU	4	8	12	16	20	21	22
0005-CCE	1	5	9	13	17	21	22
0007-ZNS	2	6	10	14	18	21	22
0008-JON	3	7	11	15	19	21	22
0009-HHW	4	8	12	16	20	21	22
0010-FLJ	1	5	9	13	17	21	22
0011-ACJ	2	6	10	14	18	21	22
0012-GLP	3	7	11	15	19	21	22
0013-EOZ	4	8	12	16	20	21	22
0014-UNY	1	5	9	13	17	21	22
0015-WND	2	6	10	14	18	21	22
0016-TMH	3	7	11	15	19	21	22
0017-XRK	4	8	12	16	20	21	22
0018-TTT	1	5	9	13	17	21	22
0020-LKN	2	6	10	14	18	21	22
0021-BYD	3	7	11	15	19	21	22
0024-TPL	4	8	12	16	20	21	22
0025-YSX	1	5	9	13	17	21	22
0026-ZFH	2	6	10	14	18	21	22
0027-KJT	3	7	11	15	19	21	22
0028-CUO	4	8	12	16	20	21	22
0029-GPU	1	5	9	13	17	21	22
0031-JRJ	2	6	10	14	18	21	22
0032-UAF	3	7	11	15	19	21	22
0033-ZYH	4	8	12	16	20	21	22
0034-GCT	1	5	9	13	17	21	22
0035-YOP	2	6	10	14	18	21	22
0036-NYK	3	7	11	15	19	21	22
0037-UPA	4	8	12	16	20	21	22
0038-FDN	1	5	9	13	17	21	22
0039-WXX	2	6	10	14	18	21	22
0040-EOF	3	7	11	15	19	21	22
0041-HZA	4	8	12	16	20	21	22

0042-JFJ	1	5	9	13	17	21	22
0043-KXW	2	6	10	14	18	21	22
0044-ZWO	3	7	11	15	19	21	22
0045-XYZ	4	8	12	16	20	21	22
0046-HDY	1	5	9	13	17	21	22
0047-KYB	2	6	10	14	18	21	22
0048-YYK	3	7	11	15	19	21	22
0049-AXK	4	8	12	16	20	21	22
0050-SBM	1	5	9	13	17	21	22
0051-LUG	2	6	10	14	18	21	22
0052-HFZ	3	7	11	15	19	21	22
0053-ZDD	4	8	12	16	20	21	22
0054-TZW	1	5	9	13	17	21	22
0055-AUL	2	6	10	14	18	21	22
0056-UZH	3	7	11	15	19	21	22
0057-KST	4	8	12	16	20	21	22
0058-LYL	1	5	9	13	17	21	22
0059-RWZ	2	6	10	14	18	21	22
0060-YXA	3	7	11	15	19	21	22
0061-JPK	4	8	12	16	20	21	22
0062-UTN	1	5	9	13	17	21	22
0063-CUA	2	6	10	14	18	21	22
0065-CSZ	3	7	11	15	19	21	22
0066-BOD	4	8	12	16	20	21	22
0067-SOM	1	5	9	13	17	21	22
0068-WCN	2	6	10	14	18	21	22
0069-DAD	3	7	11	15	19	21	22
0070-UWZ	4	8	12	16	20	21	22
0071-NKD	1	5	9	13	17	21	22
0072-XWB	2	6	10	14	18	21	22
0073-MRH	3	7	11	15	19	21	22
0075-EBA	4	8	12	16	20	21	22
0076-HUB	1	5	9	13	17	21	22
0077-FTX	2	6	10	14	18	21	22
0078-EOM	3	7	11	15	19	21	22
0079-GEB	4	8	12	16	20	21	22
0080-WXK	1	5	9	13	17	21	22
0082-ZJM	2	6	10	14	18	21	22
0083-RCR	3	7	11	15	19	21	22

0084-ZHX	4	8	12	16	20	21	22
0085-OBK	1	5	9	13	17	21	22
0086-FYC	2	6	10	14	18	21	22
0087-RYJ	3	7	11	15	19	21	22
0088-OFR	4	8	12	16	20	21	22
0089-BAY	1	5	9	13	17	21	22
0090-TJU	2	6	10	14	18	21	22
0091-HRY	3	7	11	15	19	21	22
0092-EJS	4	8	12	16	20	21	22
0093-RZR	1	5	9	13	17	21	22
0094-DLS	2	6	10	14	18	21	22
0095-JZA	3	7	11	15	19	21	22
0096-ORK	4	8	12	16	20	21	22
0097-ZEM	1	5	9	13	17	21	22
0098-MKH	2	6	10	14	18	21	22
0101-ETH	3	7	11	15	19	21	22
0103-XTR	4	8	12	16	20	21	22
0104-BFH	1	5	9	13	17	21	22
0105-OGE	2	6	10	14	18	21	22
0106-JAG	3	7	11	15	19	21	22
0107-YGC	4	8	12	16	20	21	22
0108-TER	1	5	9	13	17	21	22
0109-ENT	2	6	10	14	18	21	22
0110-TRP	3	7	11	15	19	21	22
0111-SBC	4	8	12	16	20	21	22
0112-WNM	1	5	9	13	17	21	22
0115-MTE	2	6	10	14	18	21	22
0116-JBF	3	7	11	15	19	21	22
0117-PBZ	4	8	12	16	20	21	22
0118-WPT	1	5	9	13	17	21	22
0119-DWW	2	6	10	14	18	21	22
0120-WBO	3	7	11	15	19	21	22
0121-TWB	4	8	12	16	20	21	22
0122-AKX	1	5	9	13	17	21	22
0123-PBF	2	6	10	14	18	21	22
0124-TXF	3	7	11	15	19	21	22
0125-YAC	4	8	12	16	20	21	22
0126-SYL	1	5	9	13	17	21	22
0128-KKF	2	6	10	14	18	21	22

0130-DNA	3	7	11	15	19	21	22
0131-CKD	4	8	12	16	20	21	22
0132-ZHL	1	5	9	13	17	21	22
0133-SAU	2	6	10	14	18	21	22
0134-APL	3	7	11	15	19	21	22
0135-EFK	4	8	12	16	20	21	22
0136-TJH	1	5	9	13	17	21	22
0137-BFA	2	6	10	14	18	21	22
0138-XZL	3	7	11	15	19	21	22
0139-SRA	4	8	12	16	20	21	22
0140-LLH	1	5	9	13	17	21	22
0141-ZKW	2	6	10	14	18	21	22
0142-WDS	3	7	11	15	19	21	22
0143-CXY	4	8	12	16	20	21	22
0144-NLS	1	5	9	13	17	21	22
0145-OHX	2	6	10	14	18	21	22
0146-GEB	3	7	11	15	19	21	22
0147-DLX	4	8	12	16	20	21	22
0148-FSU	1	5	9	13	17	21	22
0149-AGG	2	6	10	14	18	21	22
0150-BBD	3	7	11	15	19	21	22
0151-ABZ	4	8	12	16	20	21	22
0152-FAE	1	5	9	13	17	21	22
0153-YBJ	2	6	10	14	18	21	22
0154-JGE	3	7	11	15	19	21	22
0155-YPL	4	8	12	16	20	21	22
0156-KNO	1	5	9	13	17	21	22
0157-JKM	2	6	10	14	18	21	22
0158-ETP	3	7	11	15	19	21	22
0159-PFG	4	8	12	16	20	21	22
0160-YMJ	1	5	9	13	17	21	22
0161-ESS	2	6	10	14	18	21	22
0162-BWS	3	7	11	15	19	21	22
0163-HNJ	4	8	12	16	20	21	22
0164-NWJ	1	5	9	13	17	21	22
0165-UUU	2	6	10	14	18	21	22
0166-NWH	3	7	11	15	19	21	22
0167-HBB	4	8	12	16	20	21	22
0168-UWG	1	5	9	13	17	21	22

0169-BRG	2	6	10	14	18	21	22
0171-ULG	3	7	11	15	19	21	22
0172-XEB	4	8	12	16	20	21	22
0173-XKB	1	5	9	13	17	21	22
0174-EJR	2	6	10	14	18	21	22
0175-BDH	3	7	11	15	19	21	22
0176-HJL	4	8	12	16	20	21	22
0177-NSE	1	5	9	13	17	21	22
0178-AMC	2	6	10	14	18	21	22
0179-ELX	3	7	11	15	19	21	22
0180-GYT	4	8	12	16	20	21	22
0181-SHR	1	5	9	13	17	21	22
0182-XHN	2	6	10	14	18	21	22
0183-ZTP	3	7	11	15	19	21	22
0184-ZPZ	4	8	12	16	20	21	22
0185-HGO	1	5	9	13	17	21	22
0186-ECP	2	6	10	14	18	21	22
0187-DYZ	3	7	11	15	19	21	22
0188-WJJ	4	8	12	16	20	21	22
0189-SDM	1	5	9	13	17	21	22
0190-PZT	2	6	10	14	18	21	22
0191-BGS	3	7	11	15	19	21	22
0192-WTN	4	8	12	16	20	21	22
0193-LON	1	5	9	13	17	21	22
0194-TAN	2	6	10	14	18	21	22
0195-MDX	3	7	11	15	19	21	22
0196-YDD	4	8	12	16	20	21	22
0197-CZL	1	5	9	13	17	21	22
0198-LJJ	2	6	10	14	18	21	22
0200-BOB	3	7	11	15	19	21	22
0201-CNS	4	8	12	16	20	21	22
0202-YME	1	5	9	13	17	21	22
0203-YRT	2	6	10	14	18	21	22
0204-COY	3	7	11	15	19	21	22
0205-GRU	4	8	12	16	20	21	22
0206-YBZ	1	5	9	13	17	21	22
0207-BWP	2	6	10	14	18	21	22
0208-WJU	3	7	11	15	19	21	22
0209-UMZ	4	8	12	16	20	21	22

0210-LSP	1	5	9	13	17	21	22
0211-ECO	2	6	10	14	18	21	22
0212-LNG	3	7	11	15	19	21	22
0213-PLW	4	8	12	16	20	21	22
0214-WPA	1	5	9	13	17	21	22
0215-TEN	2	6	10	14	18	21	22
0216-FJU	3	7	11	15	19	21	22
0217-BWK	4	8	12	16	20	21	22
0218-RFN	1	5	9	13	17	21	22
0219-AMG	2	6	10	14	18	21	22
0220-LFE	3	7	11	15	19	21	22
0221-CLS	4	8	12	16	20	21	22
0222-KON	1	5	9	13	17	21	22
0223-ZXT	2	6	10	14	18	21	22
0224-GKY	3	7	11	15	19	21	22
0225-TKD	4	8	12	16	20	21	22
0226-WPZ	1	5	9	13	17	21	22
0227-MXJ	2	6	10	14	18	21	22
0228-YAC	3	7	11	15	19	21	22
0230-JWU	4	8	12	16	20	21	22
0231-ZEA	1	5	9	13	17	21	22
0232-FRZ	2	6	10	14	18	21	22
0233-MOX	3	7	11	15	19	21	22
0234-OOH	4	8	12	16	20	21	22
0235-YSZ	1	5	9	13	17	21	22
0236-PYJ	2	6	10	14	18	21	22
0237-DDN	3	7	11	15	19	21	22
0238-FEU	4	8	12	16	20	21	22
0239-DSS	1	5	9	13	17	21	22
0240-MGC	2	6	10	14	18	21	22
0241-CKC	3	7	11	15	19	21	22
0242-ROZ	4	8	12	16	20	21	22
0243-CRY	1	5	9	13	17	21	22
0244-FTA	2	6	10	14	18	21	22
0245-KTE	3	7	11	15	19	21	22
0246-DZB	4	8	12	16	20	21	22
0247-GLC	1	5	9	13	17	21	22
0248-KOP	2	6	10	14	18	21	22
0249-TLL	3	7	11	15	19	21	22

0250-HWS	4	8	12	16	20	21	22
0251-PGS	1	5	9	13	17	21	22
0252-CPG	2	6	10	14	18	21	22
0253-HZA	3	7	11	15	19	21	22
0254-GJE	4	8	12	16	20	21	22
0255-MMK	1	5	9	13	17	21	22
0256-RAJ	2	6	10	14	18	21	22
0257-PYN	3	7	11	15	19	21	22
0258-DTG	4	8	12	16	20	21	22
0259-AFO	1	5	9	13	17	21	22
0260-JLP	2	6	10	14	18	21	22
0261-CNS	3	7	11	15	19	21	22
0262-KLP	4	8	12	16	20	21	22
0263-DGO	1	5	9	13	17	21	22
0264-WLX	2	6	10	14	18	21	22
0265-HSB	3	7	11	15	19	21	22
0266-PKL	4	8	12	16	20	21	22
0267-BDF	1	5	9	13	17	21	22
0268-XWA	2	6	10	14	18	21	22
0269-LYA	3	7	11	15	19	21	22
0270-UCE	4	8	12	16	20	21	22
0271-MWN	1	5	9	13	17	21	22
0272-GKB	2	6	10	14	18	21	22
0273-DKO	3	7	11	15	19	21	22
0274-ZDN	4	8	12	16	20	21	22
0275-ASG	1	5	9	13	17	21	22
0276-NNF	2	6	10	14	18	21	22
0277-JOP	3	7	11	15	19	21	22
0278-SAH	4	8	12	16	20	21	22
0279-KPJ	1	5	9	13	17	21	22
0280-HGD	2	6	10	14	18	21	22
0281-XDC	3	7	11	15	19	21	22
0282-GWZ	4	8	12	16	20	21	22
0283-KXT	1	5	9	13	17	21	22
0284-BER	2	6	10	14	18	21	22
0286-FOE	3	7	11	15	19	21	22
0287-NUJ	4	8	12	16	20	21	22
0288-EAA	1	5	9	13	17	21	22
0289-KJD	2	6	10	14	18	21	22

0291-TGS	3	7	11	15	19	21	22
0292-PYX	4	8	12	16	20	21	22
0293-FJP	1	5	9	13	17	21	22
0295-KUH	2	6	10	14	18	21	22
0296-USK	3	7	11	15	19	21	22
0297-ERY	4	8	12	16	20	21	22
0298-BJA	1	5	9	13	17	21	22
0299-PXC	2	6	10	14	18	21	22
0300-TAJ	3	7	11	15	19	21	22
0301-JAK	4	8	12	16	20	21	22
0302-JMZ	1	5	9	13	17	21	22
0303-UTC	2	6	10	14	18	21	22
0304-TMP	3	7	11	15	19	21	22
0305-CLB	4	8	12	16	20	21	22
0306-YFT	1	5	9	13	17	21	22
0307-DGP	2	6	10	14	18	21	22
0308-OFW	3	7	11	15	19	21	22
0309-HMK	4	8	12	16	20	21	22
0310-ORK	1	5	9	13	17	21	22
0311-WHR	2	6	10	14	18	21	22
0312-WZH	3	7	11	15	19	21	22
0313-ZOL	4	8	12	16	20	21	22
0314-SEH	1	5	9	13	17	21	22
0315-FNT	2	6	10	14	18	21	22
0316-EKR	3	7	11	15	19	21	22
0317-BTW	4	8	12	16	20	21	22
0318-YOL	1	5	9	13	17	21	22
0319-KFK	2	6	10	14	18	21	22
0320-JOY	3	7	11	15	19	21	22
0321-DXY	4	8	12	16	20	21	22
0322-PPZ	1	5	9	13	17	21	22
0323-YNL	2	6	10	14	18	21	22
0324-UMR	3	7	11	15	19	21	22
0325-AUS	4	8	12	16	20	21	22
0326-OXX	1	5	9	13	17	21	22
0327-HEL	2	6	10	14	18	21	22
0328-DZC	3	7	11	15	19	21	22
0329-AOR	4	8	12	16	20	21	22
0330-MKZ	1	5	9	13	17	21	22

0331-XYA	2	6	10	14	18	21	22
0332-RDZ	3	7	11	15	19	21	22
0333-YCC	4	8	12	16	20	21	22
0334-JTB	1	5	9	13	17	21	22
0335-XCR	2	6	10	14	18	21	22
0336-FZO	3	7	11	15	19	21	22
0337-LZU	4	8	12	16	20	21	22
0338-EGO	1	5	9	13	17	21	22
0339-AGS	2	6	10	14	18	21	22
0340-UHM	3	7	11	15	19	21	22
0341-WXG	4	8	12	16	20	21	22
0342-MBL	1	5	9	13	17	21	22
0343-SPJ	2	6	10	14	18	21	22
0344-XME	3	7	11	15	19	21	22
0345-ZNF	4	8	12	16	20	21	22
0346-TDB	1	5	9	13	17	21	22
0347-CND	2	6	10	14	18	21	22
0348-NSG	3	7	11	15	19	21	22
0349-XKF	4	8	12	16	20	21	22
0350-HFZ	1	5	9	13	17	21	22
0351-ZGH	2	6	10	14	18	21	22
0352-DTX	3	7	11	15	19	21	22
0353-YAW	4	8	12	16	20	21	22
0354-YPC	1	5	9	13	17	21	22
0355-XTE	2	6	10	14	18	21	22
0356-NRZ	3	7	11	15	19	21	22
0357-LUA	4	8	12	16	20	21	22
0358-BOM	1	5	9	13	17	21	22
0359-YLK	2	6	10	14	18	21	22
0360-FYU	3	7	11	15	19	21	22
0361-MYA	4	8	12	16	20	21	22
0362-ZNW	1	5	9	13	17	21	22
0363-BMY	2	6	10	14	18	21	22
0364-RZA	3	7	11	15	19	21	22
0365-KYY	4	8	12	16	20	21	22
0366-SRJ	1	5	9	13	17	21	22
0367-UTS	2	6	10	14	18	21	22
0368-HGY	3	7	11	15	19	21	22
0369-XTR	4	8	12	16	20	21	22

Answer form for multiple choice. You can make your own form, put please be clear and answer on <u>one</u> page. Do <u>not</u> submit solutions to the multiple-choice problems.

Number	Part	A	B	C	D	E
	a.					
	b.					
	a.					
	b.					
	a.					
	b.					
	a.					
	b.					
	a.					
	b.					

Problem 1

Twenty students take a math test. Their scores are listed here:

27	57	15	84	1	26	13	23	70	9	54	6	12	8	69	100	27	11	12	41

a) Find the 80th percentile of the students' scores, according to the method taught in the course. (5p) Choose the alternative closest to your answer.

(A) 56.4
(B) 57.0
(C) 60.0
(D) 63.0
(E) 66.6

Suppose that 85% of Swedish adults drank at least one drink alcohol during 2020. We draw a simple random sample of 10 Swedish adults.

b) Find the probability that at least 9 on the Swedes in the sample drank alcohol during 2020. (5p) Choose the alternative closest to your answer.

(A) 0.18
(B) 0.46
(C) 0.54
(D) 0.82
(E) 1.00

Problem 2

Twenty students take a math test. Their scores are listed here:

74	37	85	48	51	59	17	30	16	45	92	17	5	85	48	1	16	62	73	11

a) Find the 80th percentile of the students' scores, according to the method taught in the course. (5p) Choose the alternative closest to your answer.

(A) 70.8
(B) 73.0
(C) 73.3
(D) 73.5
(E) 73.8

Suppose that 85% of Swedish adults drank at least one drink alcohol during 2020. We draw a simple random sample of 10 Swedish adults.

b) Find the probability that at least 8 on the Swedes in the sample drank alcohol during 2020. (5p) Choose the alternative closest to your answer.

(A) 0.18
(B) 0.46
(C) 0.54
(D) 0.82
(E) 1.00

Problem 3

Twenty students take a math test. Their scores are listed here:

77	46	23	75	43	80	53	8	49	56	42	95	30	18	18	99	88	62	30	55

a) Find the 80th percentile of the students' scores, according to the method taught in the course. (5p) Choose the alternative closest to your answer.

(A) 76.6
(B) 77.0
(C) 77.8
(D) 78.5
(E) 79.4

Suppose that 80% of Swedish adults drank at least one drink alcohol during 2020. We draw a simple random sample of 10 Swedish adults.

b) Find the probability that at least 7 on the Swedes in the sample drank alcohol during 2020. (5p) Choose the alternative closest to your answer.

(A) 0.33
(B) 0.67
(C) 0.88
(D) 0.96
(E) 1.00

Problem 4

Twenty students take a math test. Their scores are listed here:

34	63	7	30	68	62	26	65	63	62	95	94	85	53	44	1	91	45	3	99

a) Find the 80th percentile of the students' scores, according to the method taught in the course. (5p) Choose the alternative closest to your answer.

(A) 81.6
(B) 85.0
(C) 86.5
(D) 88.0
(E) 89.8

Suppose that 80% of Swedish adults drank at least one drink alcohol during 2020. We draw a simple random sample of 10 Swedish adults.

b) Find the probability that at least 8 on the Swedes in the sample drank alcohol during 2020. (5p) Choose the alternative closest to your answer.

(A) 0.33
(B) 0.68
(C) 0.88
(D) 0.96
(E) 1.00

Problem 5

A group of 10 friends are going to play a soccer game. The group of friends consist of 6 women and 4 men.

Men: Adam, Bo, Carl, David

Women: Emma, Frida, Greta, Hanna, Ida, Jenny

It is decided that the ”home team” will consist of five players, so five names are drawn randomly. The remaining 5 names will be in the “away team”.

a) How many different ”home teams” are possible? Order does not matter. (5p)

(A) 120
(B) 240
(C) 252
(D) 720
(E) 30240

b) Find the probability that the home team will be all female (five women). (5p) Choose the alternative closest to your answer.

(A) 0.024
(B) 0.036
(C) 0.048
(D) 0.060
(E) 0.072

Problem 6

A group of 10 friends are going to play a soccer game. The group of friends consist of 5 women and 5 men.

Men: Adam, Bo, Carl, David, Erik

Women: Frida, Greta, Hanna, Ida, Jenny

It is decided that the ”home team” will consist of five players, so five names are drawn randomly. The remaining 5 names will be in the “away team”.

a) How many different ”home teams” are possible? Order does not matter. (5p)

(A) 120
(B) 240
(C) 252
(D) 720
(E) 30240

b) Find the probability that the home team will be all female (five women). (5p) Choose the alternative closest to your answer.

(A) 0.002
(B) 0.004
(C) 0.008
(D) 0.016
(E) 0.032

Problem 7

A group of 10 friends are going to play a soccer game. The group of friends consist of 7 women and 3 men.

Men: Adam, Bo, Carl

Women: Diana, Emma, Frida, Greta, Hanna, Ida, Jenny

It is decided that the ”home team” will consist of five players, so five names are drawn randomly. The remaining 5 names will be in the “away team”.

a) How many different ”home teams” are possible? Order does not matter. (5p)

(A) 120
(B) 240
(C) 252
(D) 720
(E) 30240

b) Find the probability that the home team will be all female (five women). (5p) Choose the alternative closest to your answer.

(A) 0.08
(B) 0.09
(C) 0.11
(D) 0.12
(E) 0.13

Problem 8

A group of 10 friends are going to play a soccer game. The group of friends consist of 8 women and 2 men.

Men: Adam, Bo

Women: Charlotta, Diana, Emma, Frida, Greta, Hanna, Ida, Jenny

It is decided that the ”home team” will consist of five players, so five names are drawn randomly. The remaining 5 names will be in the “away team”.

a) How many different ”home teams” are possible? Order does not matter. (5p)

(A) 120
(B) 240
(C) 252
(D) 720
(E) 30240

b) Find the probability that the home team will be all female (five women). (5p) Choose the alternative closest to your answer.

(A) 0.12
(B) 0.15
(C) 0.17
(D) 0.22
(E) 0.27

Problem 9

Tore owns two stores: "Tore's Sneaker Shop" and "Vegan Vitamins". He estimates that his revenue for June will approximately normally distributed for both stores. If X is the June revenue, in thousands of SEK, from "Tore's Sneaker Shop" and Y is the June revenue, in thousands of SEK, from "Vegan Vitamins" then, according to Tore's model,

$X \sim N(100, 10^2)$
$Y \sim N(200, 20^2)$
with
$Cov(X, Y) = 120$

a) **Find the probability that the June revenue from the store Vegan Vitamins will be between 170 thousand and 230 thousand SEK. (5p)** Choose the alternative closest to your answer.

(A) 0.57
(B) 0.67
(C) 0.77
(D) 0.87
(E) 0.97

b) **Find the probability that the total June revenue (the two stores combined) will be at least 330 thousand SEK. (5p)** Choose the alternative closest to your answer.

(A) 0.09
(B) 0.11
(C) 0.14
(D) 0.17
(E) 0.20

Problem 10

Tore owns two stores: "Tore's Sneaker Shop" and "Vegan Vitamins". He estimates that his revenue for June will approximately normally distributed for both stores. If X is the June revenue, in thousands of SEK, from "Tore's Sneaker Shop" and Y is the June revenue, in thousands of SEK, from "Vegan Vitamins" then, according to Tore's model,

$X \sim N(100, 10^2)$
$Y \sim N(300, 20^2)$
with
$Cov(X, Y) = 160$

a) **Find the probability that the June revenue from the store Vegan Vitamins will be between 260 thousand and 340 thousand SEK. (5p)** Choose the alternative closest to your answer.

(A) 0.55
(B) 0.65
(C) 0.75
(D) 0.85
(E) 0.95

b) **Find the probability that the total June revenue (the two stores combined) will be at least 420 thousand SEK. (5p)** Choose the alternative closest to your answer.

(A) 0.19
(B) 0.22
(C) 0.24
(D) 0.26
(E) 0.28

Problem 11

Tore owns two stores: "Tore's Sneaker Shop" and "Vegan Vitamins". He estimates that his revenue for June will approximately normally distributed for both stores. If X is the June revenue, in thousands of SEK, from "Tore's Sneaker Shop" and Y is the June revenue, in thousands of SEK, from "Vegan Vitamins" then, according to Tore's model,

$X \sim N(200, 10^2)$
$Y \sim N(200, 30^2)$
with
$Cov(X, Y) = 150$

a) **Find the probability that the June revenue from the store Vegan Vitamins will be between 170 thousand and 230 thousand SEK. (5p)** Choose the alternative closest to your answer.

(A) 0.68
(B) 0.70
(C) 0.72
(D) 0.74
(E) 0.76

b) **Find the probability that the total June revenue (the two stores combined) will be at least 450 thousand SEK. (5p)** Choose the alternative closest to your answer.

(A) 0.04
(B) 0.06
(C) 0.08
(D) 0.10
(E) 0.12

Problem 12

Tore owns two stores: "Tore's Sneaker Shop" and "Vegan Vitamins". He estimates that his revenue for June will approximately normally distributed for both stores. If X is the June revenue, in thousands of SEK, from "Tore's Sneaker Shop" and Y is the June revenue, in thousands of SEK, from "Vegan Vitamins" then, according to Tore's model,

$X \sim N(100, 10^2)$
$Y \sim N(300, 30^2)$
with
$Cov(X, Y) = 100$

a) **Find the probability that the June revenue from the store Vegan Vitamins will be between 280 thousand and 320 thousand SEK. (5p)** Choose the alternative closest to your answer.

(A) 0.50
(B) 0.54
(C) 0.58
(D) 0.62
(E) 0.66

b) **Find the probability that the total June revenue (the two stores combined) will be at least 460 thousand SEK. (5p)** Choose the alternative closest to your answer.

(A) 0.04
(B) 0.06
(C) 0.08
(D) 0.10
(E) 0.12

Problem 13

Statistics Sweden (Statistiska Centralbyrån) studied the restaurant and fast-food expenses of single people in Sweden. Their study included randomly chosen 900 single individuals. The sample mean was 9800 kr per year and the sample standard deviation was 36000.

a) **Calculate a 95% confidence interval for the mean yearly restaurant and fast-food expenses of single Swedes. (5p)** Choose the alternative closest to your answer.

(A) (3952, 15647)
(B) (4826, 14774)
(C) (5700, 13900)
(D) (6574, 13026)
(E) (7448, 12152)

People in a simple random sample of 200 adults in Stockholm were asked "Do you own any stocks?" Out of the 200, 42 answered "yes" and the rest answered "no."

b) **Based on this sample, create a 90% confidence interval for the proportion of Swedish adults who own stocks. (5p)**

(A) (0.12, 0.30)
(B) (0.14, 0.28)
(C) (0.16, 0.26)
(D) (0.18, 0.24)
(E) (0.20, 0.22)

Problem 14

Statistics Sweden (Statistiska Centralbyrån) studied the restaurant and fast-food expenses of single people in Sweden. Their study included randomly chosen 900 single individuals. The sample mean was 10500 kr per year and the sample standard deviation was 33000.

a) **Calculate a 90% confidence interval for the mean yearly restaurant and fast-food expenses of single Swedes. (5p)** Choose the alternative closest to your answer.

(A) (5985, 15015)
(B) (6887, 14113)
(C) (7789, 13211)
(D) (8691, 12309)
(E) (9593, 11407)

People in a simple random sample of 200 adults in Stockholm were asked "Do you own any stocks?" Out of the 200, 44 answered "yes" and the rest answered "no."

b) **Based on this sample, create a 95% confidence interval for the proportion of Swedish adults who own stocks. (5p)**

(A) (0.12, 0.32)
(B) (0.13, 0.31)
(C) (0.14, 0.30)
(D) (0.15, 0.29)
(E) (0.16, 0.28)

Problem 15

Statistics Sweden (Statistiska Centralbyrån) studied the restaurant and fast-food expenses of single people in Sweden. Their study included randomly chosen 900 single individuals. The sample mean was 9100 kr per year and the sample standard deviation was 31000.

a) **Calculate a 99% confidence interval for the mean yearly restaurant and fast-food expenses of single Swedes. (5p)** Choose the alternative closest to your answer.

(A) (5427, 12773)
(B) (5764, 12435)
(C) (6101, 12099)
(D) (6438, 11762)
(E) (6775, 11425)

People in a simple random sample of 200 adults in Stockholm were asked "Do you own any stocks?" Out of the 200, 38 answered "yes" and the rest answered "no."

b) **Based on this sample, create a 95% confidence interval for the proportion of Swedish adults who own stocks. (5p)**

(A) (0.11, 0.27)
(B) (0.12, 0.26)
(C) (0.14, 0.24)
(D) (0.17, 0.25)
(E) (0.19, 0.27)

Problem 16

Statistics Sweden (Statistiska Centralbyrån) studied the restaurant and fast-food expenses of single people in Sweden. Their study included randomly chosen 900 single individuals. The sample mean was 10100 kr per year and the sample standard deviation was 35000.

a) **Calculate a 90% confidence interval for the mean yearly restaurant and fast-food expenses of single Swedes. (5p)** Choose the alternative closest to your answer.

(A) (7959, 13035)
(B) (8181, 12019)
(C) (8403, 11002)
(D) (8625, 9987)
(E) (8847, 11353)

People in a simple random sample of 200 adults in Stockholm were asked "Do you own any stocks?" Out of the 200, 46 answered "yes" and the rest answered "no."

b) **Based on this sample, create a 95% confidence interval for the proportion of Swedish adults who own stocks. (5p)**

(A) (0.13, 0.33)
(B) (0.14, 0.32)
(C) (0.16, 0.30)
(D) (0.17, 0.29)
(E) (0.19, 0.27)

Problem 17

Forty-two randomly chosen volunteers took part in a psychology experiment. Twenty-one were assigned to the **high-power group**, while the remaining twenty-one were assigned to the **low-power group**.

First, the testosterone level of each participant was measured. Then, the twenty-one who took part in the treatment group were asked to take so called high-power poses (see figure 1) before their testosterone levels were measured again. The low-power group was asked to take low-power poses (see figure 2) before their testosterone levels were measured again.

The mean change in testosterone levels for the two groups, the sample standard deviations of the changes, and the sample sizes, can be found in the table below:

	Mean Change, testosterone (µg/dl)	**Sample Standard deviation**	**Sample size**
High-Power (x)	8	67	21
Low-power (y)	-4	70	21

You may assume that the changes are normally distributed for both groups. The scientists test the hypothesis that the change in testosterone levels is more positive in the high-power group than in the low-power group. Assume that the population variances are the same for the two groups.

a) **Calculate the value of the test variable (5p)**. Choose the value closest to your answer.

(A) 0.22
(B) 0.31
(C) 0.57
(D) 1.25
(E) 1.39

A group of German scientists perform an identical experiment (same method and set-up, same number of participants). They calculate the test variable and get 1.2.

b) **Use your formula sheet to find the interval that contains the p-value of their test statistic. (5p)**

(A) (0, 0.01)
(B) (0.01, 0.025)
(C) (0.025, 0.05)
(D) (0.05, 0.10)
(E) (0.10, 1)

Fig. 1. The two high-power poses used in the study. Participants in the high-power-pose condition were posed in expansive positions with open limbs.

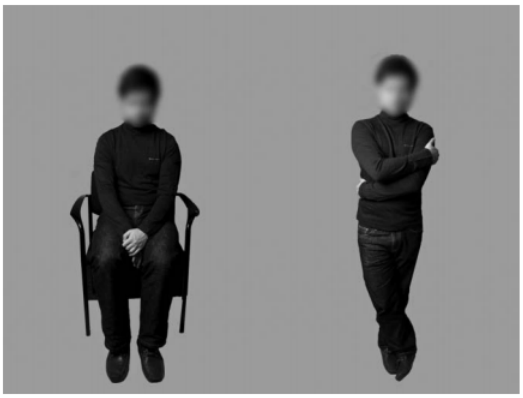

Fig. 2. The two low-power poses used in the study. Participants in the low-power-pose condition were posed in contractive positions with closed limbs.

Figures 1 and 2

Images: Carney DR, Cuddy AJC, Yap AJ. Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance. *Psychological Science*. 2010;21(10):1363-1368. doi:10.1177/0956797610383437

Problem 18

Eighty-two randomly chosen volunteers took part in a psychology experiment. Forty-one were assigned to the **high-power group**, while the remaining forty-one were assigned to the **low-power group**.

First, the testosterone level of each participant was measured. Then, the forty-one who took part in the treatment group were asked to take so called high-power poses (see figure 1) before their testosterone levels were measured again. The low-power group was asked to take low-power poses (see figure 2) before their testosterone levels were measured again.

The mean change in testosterone levels for the two groups, the sample standard deviations of the changes, and the sample sizes, can be found in the table below:

	Mean Change, testosterone (µg/dl)	**Sample Standard deviation**	**Sample size**
High-Power (x)	7	58	41
Low-power (y)	-5	61	41

You may assume that the changes are normally distributed for both groups. The scientists test the hypothesis that the change in testosterone levels is more positive in the high-power group than in the low-power group. Assume that the population variances are the same for the two groups.

a) **Calculate the value of the test variable (5p)**. Choose the value closest to your answer.

(A) 0.44
(B) 0.57
(C) 0.91
(D) 1.49
(E) 1.82

A group of German scientists perform an identical experiment (same method and set-up, same number of participants). They calculate the test variable and get 1.5.

b) **Use your formula sheet to find the interval that contains the p-value of their test statistic. (5p)**

(A) (0, 0.01)
(B) (0.01, 0.025)
(C) (0.025, 0.05)
(D) (0.05, 0.10)
(E) (0.10, 1)

Fig. 1. The two high-power poses used in the study. Participants in the high-power-pose condition were posed in expansive positions with open limbs.

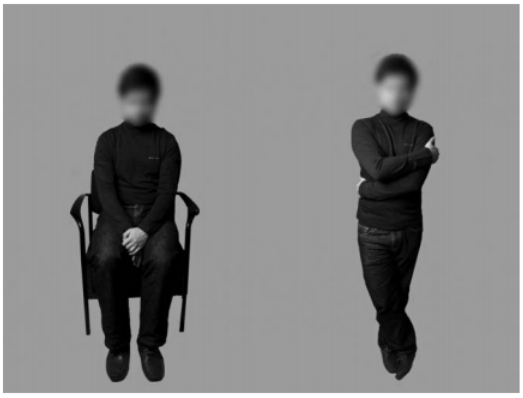

Fig. 2. The two low-power poses used in the study. Participants in the low-power-pose condition were posed in contractive positions with closed limbs.

Figures 1 and 2

Images: Carney DR, Cuddy AJC, Yap AJ. Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance. *Psychological Science*. 2010;21(10):1363-1368. doi:10.1177/0956797610383437

Problem 19

Sixty-two randomly chosen volunteers took part in a psychology experiment. Thirty-one were assigned to the **high-power group**, while the remaining thirty-one were assigned to the **low-power group**.

First, the testosterone level of each participant was measured. Then, the thirty-one who took part in the treatment group were asked to take so called high-power poses (see figure 1) before their testosterone levels were measured again. The low-power group was asked to take low-power poses (see figure 2) before their testosterone levels were measured again.

The mean change in testosterone levels for the two groups, the sample standard deviations of the changes, and the sample sizes, can be found in the table below:

	Mean Change, testosterone (µg/dl)	**Sample Standard deviation**	**Sample size**
High-Power (x)	11	77	31
Low-power (y)	-2	75	31

You may assume that the changes are normally distributed for both groups. The scientists test the hypothesis that the change in testosterone levels is more positive in the high-power group than in the low-power group. Assume that the population variances are the same for the two groups.

a) **Calculate the value of the test variable (5p)**. Choose the value closest to your answer.

(A) 0.59
(B) 0.67
(C) 0.99
(D) 1.64
(E) 1.89

A group of German scientists perform an identical experiment (same method and set-up, same number of participants). They calculate the test variable and get 1.8.

b) **Use your formula sheet to find the interval that contains the p-value of their test statistic. (5p)**

(A) (0, 0.01)
(B) (0.01, 0.025)
(C) (0.025, 0.05)
(D) (0.05, 0.10)
(E) (0.10, 1)

Fig. 1. The two high-power poses used in the study. Participants in the high-power-pose condition were posed in expansive positions with open limbs.

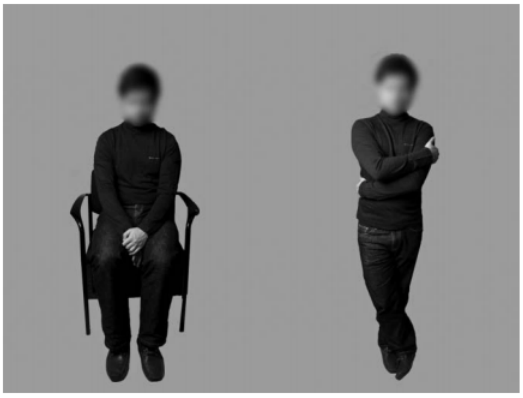

Fig. 2. The two low-power poses used in the study. Participants in the low-power-pose condition were posed in contractive positions with closed limbs.

Figures 1 and 2

Images: Carney DR, Cuddy AJC, Yap AJ. Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance. *Psychological Science*. 2010;21(10):1363-1368. doi:10.1177/0956797610383437

Problem 20

Forty-two randomly chosen volunteers took part in a psychology experiment. Twenty-one were assigned to the **high-power group**, while the remaining twenty-one were assigned to the **low-power group**.

First, the testosterone level of each participant was measured. Then, the twenty-one who took part in the treatment group were asked to take so called high-power poses (see figure 1) before their testosterone levels were measured again. The low-power group was asked to take low-power poses (see figure 2) before their testosterone levels were measured again.

The mean change in testosterone levels for the two groups, the sample standard deviations of the changes, and the sample sizes, can be found in the table below:

	Mean Change, testosterone (µg/dl)	**Sample Standard deviation**	**Sample size**
High-Power (x)	6	70	21
Low-power (y)	1	67	21

You may assume that the changes are normally distributed for both groups. The scientists test the hypothesis that the change in testosterone levels is more positive in the high-power group than in the low-power group. Assume that the population variances are the same for the two groups.

a) **Calculate the value of the test variable (5p)**. Choose the value closest to your answer.

(A) 0.24
(B) 0.36
(C) 0.69
(D) 1.19
(E) 1.30

A group of German scientists perform an identical experiment (same method and set-up, same number of participants). They calculate the test variable and get 1.5.

b) **Use your formula sheet to find the interval that contains the p-value of their test statistic. (5p)**

(A) (0, 0.01)
(B) (0.01, 0.025)
(C) (0.025, 0.05)
(D) (0.05, 0.10)
(E) (0.10, 1)

Fig. 1. The two high-power poses used in the study. Participants in the high-power-pose condition were posed in expansive positions with open limbs.

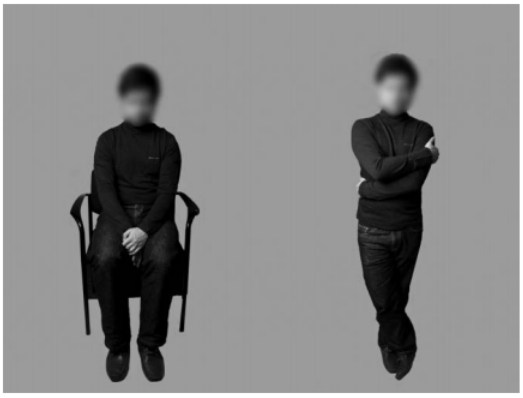

Fig. 2. The two low-power poses used in the study. Participants in the low-power-pose condition were posed in contractive positions with closed limbs.

Figures 1 and 2

Images: Carney DR, Cuddy AJC, Yap AJ. Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance. *Psychological Science*. 2010;21(10):1363-1368. doi:10.1177/0956797610383437

Problem 21

Four employees at a small marketing firm work together in a downtown office. Each week, one of the employees, Mike, draws a name, supposedly at random, to determine who will be responsible for providing sweets for Friday coffee that week. Each draw is independent of every other draw.

John, one of the four employees, suspects that the name drawing is rigged. He decides to note the winner of the lottery for the next 100 weeks (everyone is part of each drawing for those 100 weeks). The result of his data collection can be found in the table:

John	Mike	Jane	Marcy
34	15	27	24

Test at the 5% level of significance whether the probability of each name is the same in the draws.

a) **State hypotheses and the test variable. (5p)**

b) **State the critical value and decision rule. (5p)**

c) **Calculate the test statistic and draw conclusion. (5p)**

In reality, the name drawings are not rigged – John has just been unlucky. The draws continue.

d) **Given that the true probability that John's name is drawn is 25% each week, find the approximate probability that his name will be drawn more than 30 times in the next 100 weeks. (5p)**

e) **Was it possible for the test in part a)-c) to result in a type-II error? Explain. (5p)**

Problem 22

A business student in United States collects a random sample of 100 recently sold used cars of the same brand and model, Audi model A3. The data set contains the following variables:

PRICE	The final price of the sold car, in USD
MILAGE	The number of miles (1 mile = 1.609 km) that the used car had been driven before it was sold
AGE	The age of the car, in years
MANUAL	A dummy variable, 1 means manual transmission, 0 means automatic transmission

The student estimates one model:

MODEL 1: $PRICE = \beta_0 + \beta_1 * MILAGE + \beta_2 * AGE + \beta_3 * MANUAL + \varepsilon$

You can find part of the output from Model 1 on the following pages. Use the output to solve the problems.

For parts (a) and (b), test at the 5% level of significance whether β_3 is less than -1000, given that *MILAGE* and *AGE* are included in the model.

a) State the hypotheses, test variable, critical value, and decision rule. (5p)

b) Calculate the value of the test statistic and state your conclusions. (5p)

c) Calculate the coefficient of determination for model 1. Name two possible variables that could be added to the model to increase the coefficient of determination, if we had the data. (5p)

d) Figure 3 shows a histogram of the residuals from Model 1. A friend of the student remarks "six of the residuals are more than two standard deviations from the mean, so according to the empirical rule, the residuals are likely not normally distributed." Are both parts of the friend's remark correct? Explain. (5p) (tip: the standard deviation of the residuals can be found in the output)

e) Figure 4 shows pair-wise scatterplots of all the variables. Notice the scatterplot between PRICE and MILAGE. Is this pattern a problem for the validity of Model 1? Explain. (5p)

Model 1

Regression Statistics	
Multiple R	0.93789001
R Square	[redacted]
Adjusted R Square	
Standard Error	1851.93353
Observations	100

ANOVA

	df	*SS*	*MS*	*F*
Regression	3	2406219728	802073243	233.863927
Residual	96	329247149.3	3429657.81	
Total	99	2735466877		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	28102.2837	377.2070453	74.5009511	9.4914E-87
MILAGE	-0.0785755	0.013609578	[redacted]	
AGE	-1987.4357	201.2969437		
MANUAL	-1940.6245	411.6950657		

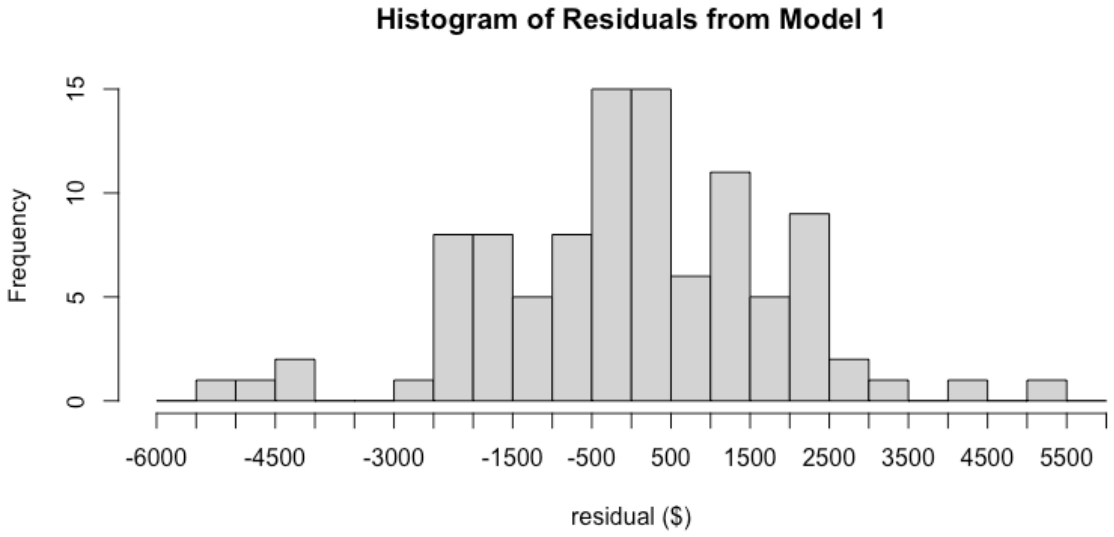

Figure 3: Histogram

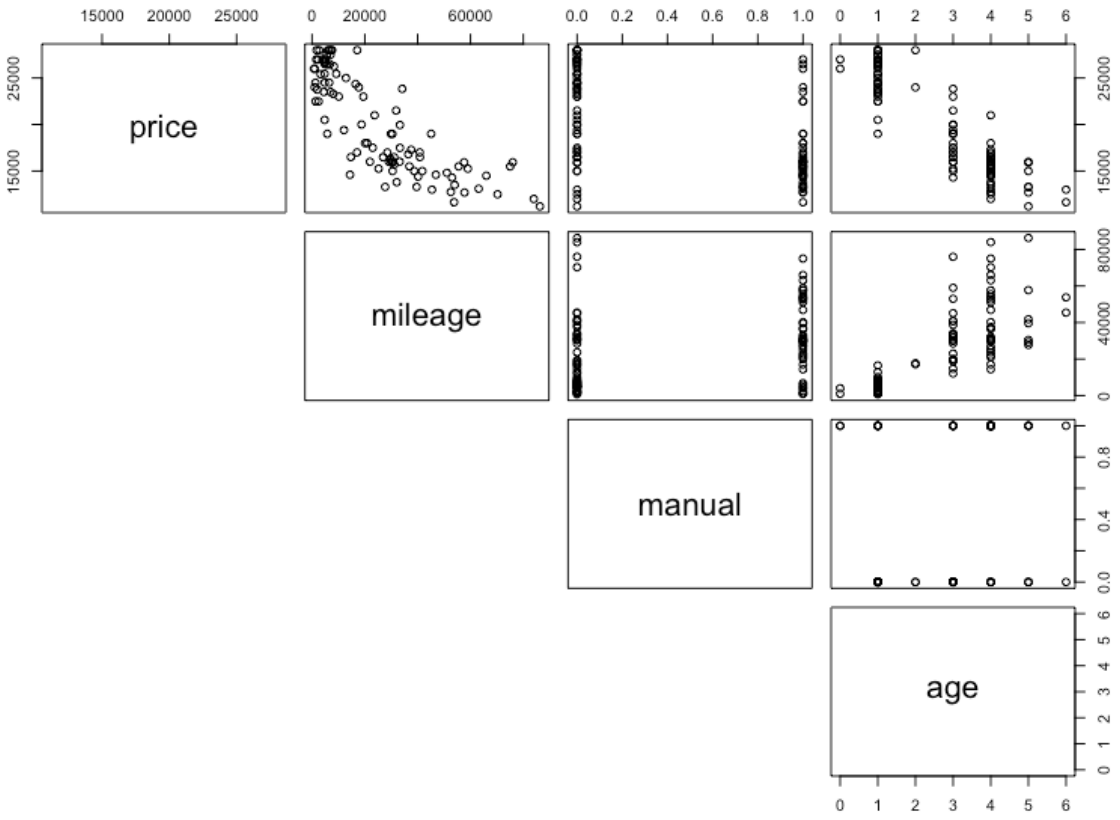

Figure 4: Scatter Plots

---END OF EXAM---