# 國立臺北大學九十六學年度碩士班招生考試試題

系（所）別：國際企業研究所

科　　目：統計學



☑可 ☐不可使用計算機

1. (15%, 5% each) Let X and Y be the two numbers appearing on two independent rolls of a dice. Find
   (a) $p(|X-Y|\le 1)$
   (b) $E(2^X)$
   (c) $E(2^{X+Y})$

2. (15%, 5% each) The table contains quarterly retail sales for a store (in NT$ millions dollars). The data begin with the 1st quarter of 1996 and end with the 4th quarter of 2001.

| Year-quarter | Sales | Year-quarter | Sales | Year-quarter | Sales |
|---|---|---|---|---|---|
| 1996-1st | 45 | 1998-1st | 67 | 2000-1st | 78 |
| 1996-2nd | 45 | 1998-2nd | 64 | 2000-2nd | 72 |
| 1996-3rd | 55 | 1998-3rd | 72 | 2000-3rd | 75 |
| 1996-4th | 82 | 1998-4th | 90 | 2000-4th | 95 |
| 1997-1st | 64 | 1999-1st | 75 | 2001-1st | 75 |
| 1997-2nd | 64 | 1999-2nd | 72 | 2001-2nd | 72 |
| 1997-3rd | 72 | 1999-3rd | 76 | 2001-3rd | 78 |
| 1997-4th | 95 | 1999-4th | 96 | 2001-4th | 95 |

We fitted the data with a trend –only model for the data is

$$\text{Sales} = 58.97 + 1.20x$$

where $x$ is the number of months elapsed since the beginning of the series.
   (a) Use moving averages based on a span of 4 to forecast sales of the 1st quarter of 2002.
   (b) We want to incorporate seasonality factors to account for the pattern that repeats every four quarters. Calculate the seasonality factor for the **1st quarter.**
   (c) What is the forecasted sale of the 3rd quarter of 1996 if we used an exponential smoothing model with a smoothing constant 0.5?

3. (10%, 5% each) The lifetimes of a component are exponentially distributed with a mean of 10 hours. Find
   (a) the probability that a component survives 20 hours.
   (b) the probability that the average lifetime of 100 independent components exceeds 11 hours. (Hint: use normal approximation).

4. (10%, 5% each) A marketing company conducted a survey for a new product. They have surveyed 400 males and 400 females. The result showed 240 males and 200 females favored the product.
   (a) Construct a 95% confidence interval for the preference difference (in proportions) between male and female.
   (b) If the proportion in the population favoring the product is 50%. What is the probability of a simple random sample of 625 subjects favoring the product is between 48% and 52%?

5. (10%)The purchasing director for an industrial parts factory is investigating the possibility of purchasing a new type of milling machine. She has determined that the new machine will be bought if there is evidence that the parts produced have a higher average breaking strength than those from the old machine. Assume that $\mu_a$ = *average breaking strength for old machine*

   $\mu_b$ = *average breaking strength for new machine*

   Find the correct statement(s):
   (a) The null hypothesis for this problem is $H_0 : \mu_a \geq \mu_b$
   (b) F test (from ANOVA) can be used to analyze this problem.
   (c) Two-Sided Two-Sample T-test can be used to analyze this problem.

6. (10%) Let $X_1$ *and* $X_2$ be independent random variables with probability density functions $f(x_1) = 2x_1,\ 0 < x_1 < 1$, *and* $f_2(x_2) = 5x_2^4,\ 0 < x_2 < 1$, *respectively.*
   *Compute* $E(X_1^2 X_2^5)$.

7. (10%)There are two regression models and the results are shown below.

   **Model 1:** $Y = \alpha_0 + \alpha_1 X_1 + \varepsilon$

| Variable | Parameter Estimate | Prob>\|T\| |
|---|---|---|
| intercept | 60 | 0.001 |
| $X_1$ | -0.7 | 0.03 |

   **Model 2:** $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$

| Variable | Parameter Estimate | Prob>\|T\| |
|---|---|---|
| intercept | -12 | 0.005 |
| $X_1$ | 6.1 | 0.22 |
| $X_2$ | 1.4 | 0.001 |

   Compare the p-values of the two models for the coefficient of $X_1$ and give a reasonable explanation of the differences in results.

8. (10%) Suppose that $x_1, x_2, x_3,$ *and* $x_4$ are independently identically distributed as normal distribution with mean $\mu$ and variance $\sigma^2$. Derive the distribution of $\frac{(x_1 - x_2)^2}{(x_4 - x_3)^2}$. (Give all the details for your derivation).

9. (10%) The moment generating function of X is $M(t) = 0.3e^{t} + 0.4e^{2t} + 0.2e^{3t} + 0.1e^{4t}$. Find E(X).

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## *Z* Table

Entries in the body of the table represents areas under the curve between −∞ and *z*

| *z* | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.5000 | 0.5040 | 0.5080 | 0.5120 | 0.5160 | 0.5199 | 0.5239 | 0.5279 | 0.5319 | 0.5359 |
| 0.1 | 0.5398 | 0.5438 | 0.5478 | 0.5517 | 0.5557 | 0.5596 | 0.5636 | 0.5675 | 0.5714 | 0.5753 |
| 0.2 | 0.5793 | 0.5832 | 0.5871 | 0.5910 | 0.5948 | 0.5987 | 0.6026 | 0.6064 | 0.6103 | 0.6141 |
| 0.3 | 0.6179 | 0.6217 | 0.6255 | 0.6293 | 0.6331 | 0.6368 | 0.6406 | 0.6443 | 0.6480 | 0.6517 |
| 0.4 | 0.6554 | 0.6591 | 0.6628 | 0.6664 | 0.6700 | 0.6736 | 0.6772 | 0.6808 | 0.6844 | 0.6879 |
| 0.5 | 0.6915 | 0.6950 | 0.6985 | 0.7019 | 0.7054 | 0.7088 | 0.7123 | 0.7157 | 0.7190 | 0.7224 |
| 0.6 | 0.7257 | 0.7291 | 0.7324 | 0.7357 | 0.7389 | 0.7422 | 0.7454 | 0.7486 | 0.7517 | 0.7549 |
| 0.7 | 0.7580 | 0.7611 | 0.7642 | 0.7673 | 0.7704 | 0.7734 | 0.7764 | 0.7794 | 0.7823 | 0.7852 |
| 0.8 | 0.7881 | 0.7910 | 0.7939 | 0.7967 | 0.7995 | 0.8023 | 0.8051 | 0.8078 | 0.8106 | 0.8133 |
| 0.9 | 0.8159 | 0.8186 | 0.8212 | 0.8238 | 0.8264 | 0.8289 | 0.8315 | 0.8340 | 0.8365 | 0.8389 |
| 1.0 | 0.8413 | 0.8438 | 0.8461 | 0.8485 | 0.8508 | 0.8531 | 0.8554 | 0.8577 | 0.8599 | 0.8621 |
| 1.1 | 0.8643 | 0.8665 | 0.8686 | 0.8708 | 0.8729 | 0.8749 | 0.8770 | 0.8790 | 0.8810 | 0.8830 |
| 1.2 | 0.8849 | 0.8869 | 0.8888 | 0.8907 | 0.8925 | 0.8944 | 0.8962 | 0.8980 | 0.8997 | 0.9015 |
| 1.3 | 0.9032 | 0.9049 | 0.9066 | 0.9082 | 0.9099 | 0.9115 | 0.9131 | 0.9147 | 0.9162 | 0.9177 |
| 1.4 | 0.9192 | 0.9207 | 0.9222 | 0.9236 | 0.9251 | 0.9265 | 0.9279 | 0.9292 | 0.9306 | 0.9319 |
| 1.5 | 0.9332 | 0.9345 | 0.9357 | 0.9370 | 0.9382 | 0.9394 | 0.9406 | 0.9418 | 0.9429 | 0.9441 |
| 1.6 | 0.9452 | 0.9463 | 0.9474 | 0.9484 | 0.9495 | 0.9505 | 0.9515 | 0.9525 | 0.9535 | 0.9545 |
| 1.7 | 0.9554 | 0.9564 | 0.9573 | 0.9582 | 0.9591 | 0.9599 | 0.9608 | 0.9616 | 0.9625 | 0.9633 |
| 1.8 | 0.9641 | 0.9649 | 0.9656 | 0.9664 | 0.9671 | 0.9678 | 0.9686 | 0.9693 | 0.9699 | 0.9706 |
| 1.9 | 0.9713 | 0.9719 | 0.9726 | 0.9732 | 0.9738 | 0.9744 | 0.9750 | 0.9756 | 0.9761 | 0.9767 |
| 2.0 | 0.9772 | 0.9778 | 0.9783 | 0.9788 | 0.9793 | 0.9798 | 0.9803 | 0.9808 | 0.9812 | 0.9817 |
| 2.1 | 0.9821 | 0.9826 | 0.9830 | 0.9834 | 0.9838 | 0.9842 | 0.9846 | 0.9850 | 0.9854 | 0.9857 |
| 2.2 | 0.9861 | 0.9864 | 0.9868 | 0.9871 | 0.9875 | 0.9878 | 0.9881 | 0.9884 | 0.9887 | 0.9890 |
| 2.3 | 0.9893 | 0.9896 | 0.9898 | 0.9901 | 0.9904 | 0.9906 | 0.9909 | 0.9911 | 0.9913 | 0.9916 |
| 2.4 | 0.9918 | 0.9920 | 0.9922 | 0.9925 | 0.9927 | 0.9929 | 0.9931 | 0.9932 | 0.9934 | 0.9936 |
| 2.5 | 0.9938 | 0.9940 | 0.9941 | 0.9943 | 0.9945 | 0.9946 | 0.9948 | 0.9949 | 0.9951 | 0.9952 |
| 2.6 | 0.9953 | 0.9955 | 0.9956 | 0.9957 | 0.9959 | 0.9960 | 0.9961 | 0.9962 | 0.9963 | 0.9964 |
| 2.7 | 0.9965 | 0.9966 | 0.9967 | 0.9968 | 0.9969 | 0.9970 | 0.9971 | 0.9972 | 0.9973 | 0.9974 |
| 2.8 | 0.9974 | 0.9975 | 0.9976 | 0.9977 | 0.9977 | 0.9978 | 0.9979 | 0.9979 | 0.9980 | 0.9981 |
| 2.9 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9984 | 0.9984 | 0.9985 | 0.9985 | 0.9986 | 0.9986 |
| 3.0 | 0.9987 | 0.9987 | 0.9987 | 0.9988 | 0.9988 | 0.9989 | 0.9989 | 0.9989 | 0.9990 | 0.9990 |

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