

## STAT 201: Elementary Statistics Session 13 & 14

### Exam III

Instructor: Haigang Liu

1. (30 points) The top free throw shooters in NBA usually have about 85% chance of making any given free throw. Suppose one player, say Kevin Durant, shot 10 free throws in a game. Answer the following questions.

a) Let  $X$  be the number of shots that Kevin made. What assumption should be checked before claiming that  $X$  has a binomial distribution?

b) Suppose  $X$  has a binomial distribution. Find its mean and variance.

c) Find the probability that he missed at most 1 free throws. *Hint:* The probability formula for binomial distribution is given by

$$P(X = x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}.$$

Besides, the mean and variance of binomial distribution is given by

$$\begin{aligned} EX &= np, \\ \text{Var}(X) &= np(1-p). \end{aligned}$$

2. (10 points) The wingspan of recently cloned monarch butterflies follows a normal distribution with mean 8 inches and standard deviation 0.75 inches. Answer the following questions.

a) What is the proportion of butterflies has a wingspan less than 7 inches? (You can either write down the R code directly, or use a z-score table, which is given in next page.)

b) What is the proportion of butterflies has a wingspan wider than 9 inches? (You can either write down the R code directly, or use a z-score table, which is given in next page.)

3. (15 points) Construct the sampling distribution of the sample proportion of heads obtained in the experiment of flipping a balanced coin three times.

4. (30 points) In the 2008 General Social Survey, respondents were asked if they favored or opposed the death penalty for people convicted of murder. Researchers had a sample size of 1902, and 1163 of them are in favor of death penalty. Answer the following questions.

a) Find  $\hat{p}$ , i.e., the sample proportion of people who say yes.

b) Find the 95% confidence interval of the sample proportion.

c) Interpret the 95% confidence interval. *Hint:* The formula that you might need is

$$s.e.(\hat{p}) = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}},$$

and the confidence interval is given by  $(\hat{p} - z_\alpha \cdot s.e.(\hat{p}), \hat{p} + z_\alpha \cdot s.e.(\hat{p}))$ .

5. (15 points) Answer the following questions.

a) Suppose  $X \sim N(\mu, \sigma^2)$ , which is normal distribution with mean  $\mu$  and standard deviation  $\sigma$ , what is the sampling distribution of  $\bar{X}$ ? Give the name of distribution, and clarify its parameters.

b) Suppose we have two populations, one follows Binomial( $n, p = 0.5$ ) and the other follows Binomial( $n, p = 0.9$ ). Which one converges faster to normal?

c) State, in plain English, the Central Limit Theorem.

**Z Score Table- chart value corresponds to area below z score.**

<b>z</b>	<b>0.09</b>	<b>0.08</b>	<b>0.07</b>	<b>0.06</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.00</b>
-3.4	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
-3.3	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005
-3.2	0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007
-3.1	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010
-3.0	0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013
-2.9	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019
-2.8	0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026
-2.7	0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035
-2.6	0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047
-2.5	0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062
-2.4	0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082
-2.3	0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107
-2.2	0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139
-2.1	0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179
-2.0	0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228
-1.9	0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287
-1.8	0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359
-1.7	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
-1.6	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
-1.5	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
-1.4	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
-1.3	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968
-1.2	0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151
-1.1	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
-1.0	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
-0.9	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
-0.8	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
-0.7	0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420
-0.6	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743
-0.5	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085
-0.4	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
-0.3	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
-0.2	0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
-0.1	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
-0.0	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000



# ANSWER SHEET PAGE ONE

First Name:

Last Name:

# ANSWER SHEET PAGE TWO

First Name:

Last Name:

# ANSWER SHEET PAGE THREE

First Name:

Last Name:

# ANSWER SHEET PAGE FOUR

First Name:

Last Name:

# ANSWER SHEET PAGE FIVE

First Name:

Last Name: