

Final Exam

2021 Fall

Name: []

E-mail: []

- Instructions

- Closed material but one-paged cheat sheet allowed (A4 size paper)
- Calculator allowed
- 풀이과정을 적어주세요

Score
Problem 1
Problem 2
Problem 3
Problem 4
Total

Problem 1. 한 야구선수의 타율이 0.3이다. (타율은 규정타석에서 안타를 기록할 확률을 의미한다.) 이 선수가 3개의 규정타석에서 1개 이상의 안타를 기록할 확률을 계산하라.
[15pts]

Problem 2. 7개의 표본으로 부터 표본평균은 36.6, 표본분산은 15.5를 얻었다. 모평균이 34와 같은지 90% 신뢰 수준에서 검증하라. [15pts]

Problem 3. 다음은 강의자료에 포함된 두 모집단의 모비율 차이에 대한 예시이다.

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Table 4. Test of path dependency on different surfaces.

Current state	Last point won by	Grass			Hard			Clay		
		Server's winning prob. in the next point (%)	Number of obs.	Z-statistics	Server's winning prob. in the next point (%)	Number of obs.	Z-statistics	Server's winning prob. in the next point (%)	Number of obs.	Z-statistics
15:15	Server	66.59	7,079	-0.19	64.40	34,302	0.76	62.06	17,513	-0.53
	Receiver	66.74	7,445		64.12	35,576		62.34	17,627	
30:15	Server	66.45	9,683	1.16	63.67	44,903	1.44	62.13	21,857	-1.67*
	Receiver	65.45	4,504		63.09	21,400		63.10	10,132	
15:30	Server	63.85	2,606	-0.41	61.83	13,130	1.11	60.77	6,829	0.44
	Receiver	64.33	4,841		61.25	24,975		60.45	13,283	
40:15	Server	69.20	9,382	1.77*	67.12	42,091	2.93***	65.06	19,972	3.60***
	Receiver	67.48	3,023		65.77	13,933		62.58	6,390	
30:30	Server	66.76	4,778	0.82	63.60	23,414	-0.12	60.58	12,180	-1.91**
	Receiver	65.97	4,805		63.65	24,212		61.78	12,017	
15:40	Server	63.66	853	0.18	61.50	4,893	0.66	60.28	2,694	1.1
	Receiver	63.32	2,669		60.96	14,691		59.08	7,932	
40:30	Server	65.74	6,360	0.06	63.52	30,304	-1.16	61.98	14,803	1.25
	Receiver	65.69	3,873		64.04	18,608		61.18	9,369	
30:40	Server	64.49	2,233	1.20	61.55	11,965	-0.04	60.06	6,310	0.43
	Receiver	62.89	3,223		61.57	17,322		59.72	9,394	
Deuce	Server	64.37	6,289	-0.42	62.79	32,997	1.09	60.82	17,458	0.08
	Receiver	64.72	6,327		62.38	33,012		60.78	17,220	

*p < 0.1; **p < 0.05; ***p < .01.

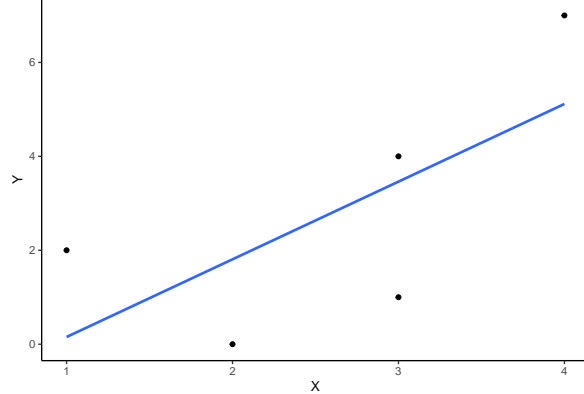
- (a) 형광색으로 표시한 1.77의 검정통계량이 맞는 수치인지 확인하라.[15pts]
- (b) 표의 하단에 *, **, ***에 대한 설명이 있다. 이 표에서 해당 별표가 의미하는 것이 알기쉽게 설명하라.[10pts]

Problem 4. 실험을 통해 확률 변수 X 와 Y 의 쌍 (X, Y) 을 아래와 같이 얻었다.

```
X <- c(1, 2, 3, 3, 4)
```

```
Y <- c(2, 0, 1, 4, 7)
```

```
## `geom_smooth()` using formula 'y ~ x'
```



- 간단한 계산을 위하여 아래의 내용을 사용할 수 있습니다.

```
c(sum(X), sum(Y))
```

```
## [1] 13 14
```

```
c(mean(X), mean(Y))
```

```
## [1] 2.6 2.8
```

```
c(sd(X), sd(Y))
```

```
## [1] 1.14 2.77
```

```
c(sum(X^2), sum(Y^2), sum(X*Y))
```

```
## [1] 39 70 45
```

- (a) Sample correlation을 구하라.[15pts]

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- (b) $H_0 : \rho_{XY} = 0$ vs. $H_1 : \rho_{XY} \neq 0$ 의 가설검정을 위한 검정통계량을 구하고 90% 수준에서 상관관계가 존재하는지 여부에 대해서 결론을 내려라.[15pts]

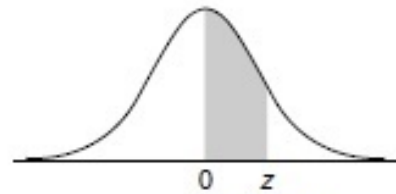
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- (c) $Y = \alpha + \beta X$ 의 linear regression을 수행하라. 즉, $\hat{\alpha}$ 와 $\hat{\beta}$ 의 값을 구하라.[15pts]

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- (d) (Bonus) 앞 페이지의 ggplot 그림을 그리기 위한 syntax를 써라.[10pts]

Table AIV.2 Standard Norms Table

Area between 0 and z

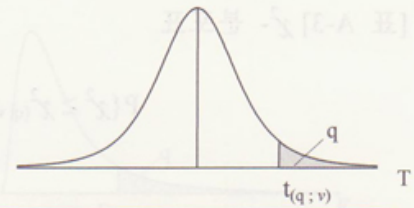
$$P(0 < Z < 1.55)$$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998

[표 A-2] t-분포표

$$P\{T \geq t_{(q; v)}\} = q$$



자유도 v	꼬리확률 q									
	0.4	0.25	0.1	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005
1	0.325	1.000	3.078	6.314	12.706	31.821	63.657	127.32	318.31	636.62
2	0.289	0.816	1.886	2.920	4.303	6.965	9.925	14.089	23.326	31.598
3	0.277	0.765	1.638	2.353	3.182	4.541	5.841	7.453	10.213	12.924
4	0.271	0.741	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5	0.267	0.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6	0.265	0.718	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7	0.263	0.711	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8	0.262	0.706	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9	0.261	0.703	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10	0.260	0.700	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11	0.260	0.697	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12	0.259	0.695	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13	0.259	0.694	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14	0.258	0.692	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15	0.258	0.691	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16	0.258	0.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17	0.257	0.689	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18	0.257	0.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19	0.257	0.688	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20	0.257	0.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21	0.257	0.686	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22	0.256	0.686	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23	0.256	0.685	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.767
24	0.256	0.685	1.318	1.711	2.064	2.492	2.792	3.091	3.467	3.745
25	0.256	0.684	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26	0.256	0.684	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27	0.256	0.684	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28	0.256	0.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29	0.256	0.683	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30	0.256	0.683	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
40	0.255	0.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
60	0.254	0.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
120	0.254	0.677	1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373
∞	0.253	0.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291

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연습종이 (떼어서 사용할 수 있습니다.)

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"Imperfection is in some sort essential to all that we know in life. -John Ruskin."