

**ADM 2304**  
**APPLIED STATISTICAL METHODS IN BUSINESS**

February 6, 2010  
9:00 – 11:00

NAME (please print): \_\_\_\_\_

Student Number: \_\_\_\_\_

SECTION REGISTERED (Circle one):

M

N

P

Q

**Instructions**

Time allowed: Two (2) hours after start of exam.

Length of Exam: 5 pages, plus a 3-page Minitab supplement (please return).

Please show all your work and explain your answers briefly where required.

You are encouraged to use the Minitab output as much as possible.

You are permitted to have a non-programmable calculator and a sheet (8.5 x 11 inch) of notes.

Statistical tables (normal and t) are provided separately (please keep).

Marks:     $\frac{\quad}{10}$     +     $\frac{\quad}{6}$     +     $\frac{\quad}{9}$     +     $\frac{\quad}{7}$     =     $\frac{\quad}{32}$

**Statement of Academic Integrity**

The School of Management does not condone academic fraud, an act by a student that may result in a false academic evaluation of that student or of another student. Without limiting the generality of this definition, academic fraud occurs when a student commits any of the following offences: plagiarism or cheating of any kind, use of books, notes, mathematical tables, dictionaries or other study aid unless an explicit written note to the contrary appears on the exam, to have in his/her possession cameras, radios (radios with head sets), tape recorders, pagers, cell phones, or any other communication device which has not been previously authorized in writing.

I have read the text on academic integrity and I pledge not to have committed or attempted to commit academic fraud in this examination.

Signed: \_\_\_\_\_

**1. [ 10 marks ]**

You have been monitoring your financial portfolio (a balanced mixture of funds, stocks and bonds) and see the one-year performance for 2009 was an increase in value of 25%. You are pleased but realize that the TSX has done much better over the same period. To test whether Canadian equity mutual funds have done better than 25%, you take a sample of 19 funds and do some simple analysis with the results in Appendix A.

- (a) Perform a test of hypothesis to determine if the data support your suspicion that Canadian equity mutual funds have performed better than your own financial portfolio. Use the .05 level of significance.

[4]

- (b) Calculate the appropriate 95% confidence interval for the average return for Canadian equity mutual funds.

[3]

- (c) Discuss whether the data support the calculations above.

[1]

- (d) Suppose you wanted to estimate the average return with a margin of error of 1%, using a 95% confidence interval. What sample size would you recommend?

[2]

**2. [ 6 marks ]**

A clinical trial is conducted to test the effectiveness of a new beta-blocker in reducing the systolic blood pressure. Fifteen cardiac patients are monitored over a 4-week period. Their blood pressures are measured before and after the clinical trial. Appendix B shows the data and various analyses.

- (a) Without looking at the data, are the two sets of blood pressure readings independent or paired? Explain briefly.

[1]

- (b) Now examine the graphs of the data and explain what would be the most appropriate test. Refer only to the specific graph(s) that is (are) relevant given your answer to (a).

[1]

- (c) Notwithstanding your answer to (b), perform a “parametric” test to determine whether the new drug is effective.

[4]

**3. [ 9 marks ]**

Health professionals are warning that more than 20% of our young adults are having health problems. These problems include obesity, hyper tension, type II diabetes and other serious conditions generally associated with much older people. The main reasons for such problems appear to be increased consumption of unhealthful (junk) food and a lack of physical activity.

In a simple random sample of 125 young adults, 35 had some of the above health problems. Use a 5% level of significance when doing the tests below.

- (a) Test the hypothesis that the proportion of young adults with health problems is greater than 20%. Use the critical value approach.

[4]

- (b) Calculate the p-value for the above test result.

[1]

- (c) Calculate the 95% confidence interval for the proportion of interest.

[3]

- (d) Explain what assumption(s) you have to make about the population of young adults.

[1]

**4. [ 7 marks ]**

A random sample of 20 male BMI values is being compared to a random sample of 20 female BMI values:

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
maleBMI	20	0	28.285	0.970	4.338	21.000	25.050	27.950	30.875
femaleBMI	20	0	22.440	0.936	4.186	16.300	19.425	20.800	25.400

Variable	Maximum
maleBMI	37.300
femaleBMI	32.300

- (a) Test whether there is sufficient evidence to claim that the average male BMI exceeds the average female BMI by more than 3. Use the .05 level of significance. Assume that the population variances are the same.

[5]

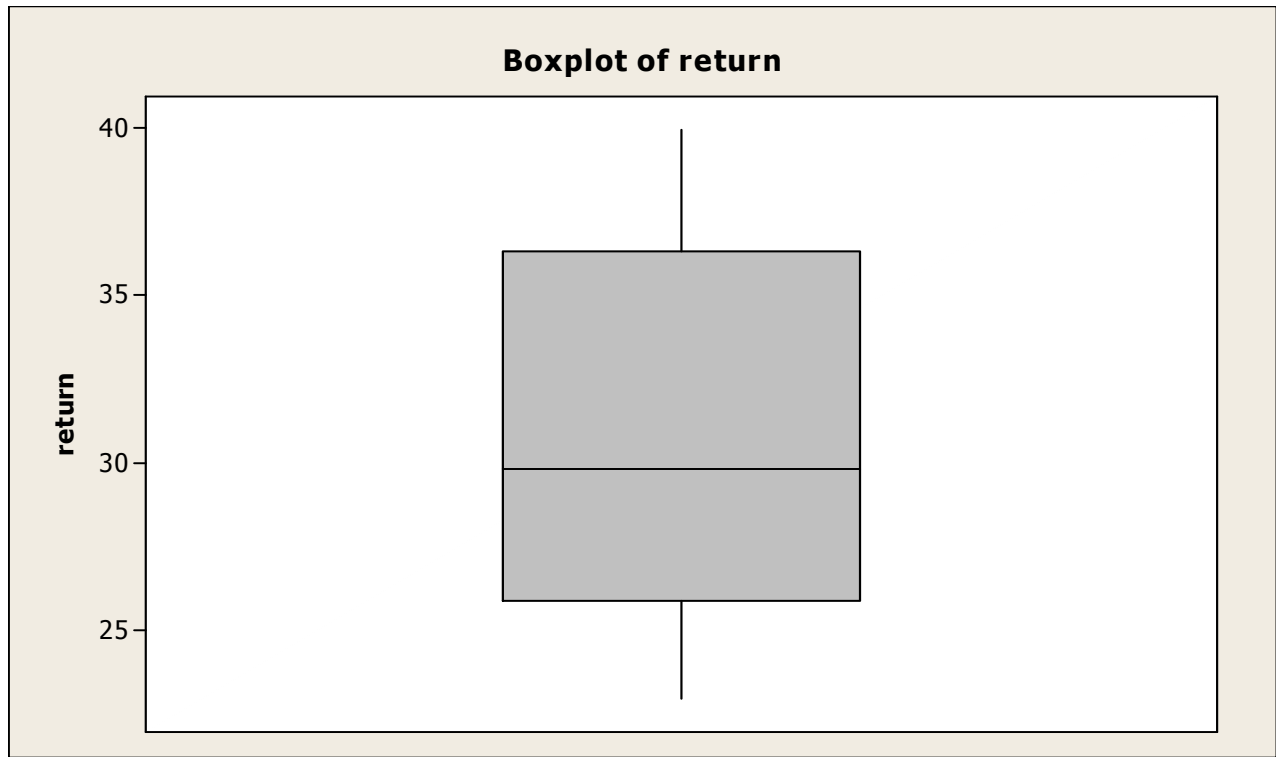
- (b) What distributional assumptions are required to justify the calculations above? Explain briefly.

[1]

- (c) What test would you perform if these assumptions were not justified?

[1]

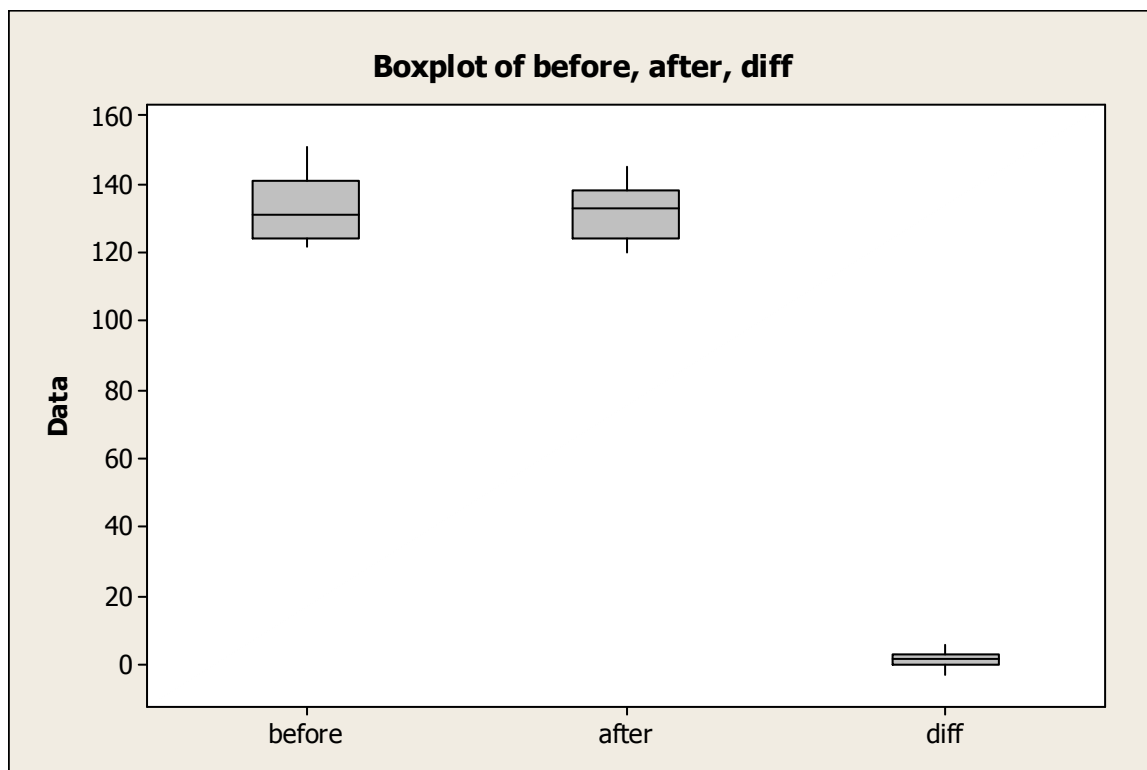
## Appendix A



Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
return	19	0	30.32	1.28	5.59	23.00	25.90	29.80	36.30	39.90

## Appendix B

before	after	diff
145	144	1
131	134	-3
123	121	2
144	140	4
135	135	0
131	130	1
126	124	2
123	123	0
122	120	2
141	138	3
136	133	3
151	145	6
136	130	6
124	124	0
131	133	-2



## Two-Sample T-Test and CI: before, after

Two-sample T for before vs after

	N	Mean	StDev	SE Mean
before	15	133.27	9.01	2.3
after	15	131.60	8.05	2.1

Difference =  $\mu$  (before) -  $\mu$  (after)

Estimate for difference: 1.66667

95% lower bound for difference: -3.64800

T-Test of difference = 0 (vs >): T-Value = 0.53 P-Value = 0.299 DF = 27

## Paired T-Test and CI: before, after

Paired T for before - after

	N	Mean	StDev	SE Mean
before	15	133.267	9.012	2.327
after	15	131.600	8.052	2.079
Difference	15	1.66667	2.55417	0.65949

95% lower bound for mean difference: 0.50511

T-Test of mean difference = 0 (vs > 0): T-Value = 2.53 P-Value = 0.012

## Mann-Whitney Test and CI: before, after

	N	Median
before	15	131.00
after	15	133.00

Point estimate for ETA1-ETA2 is 1.00

95.4 Percent CI for ETA1-ETA2 is (-6.00,8.00)

W = 245.5

Test of ETA1 = ETA2 vs ETA1 > ETA2 is significant at 0.3021

The test is significant at 0.3017 (adjusted for ties)

## Wilcoxon Signed Rank Test: diff

Test of median = 0.000000 versus median > 0.000000

	N	for	Wilcoxon	Estimated	
	N	Test	Statistic	P	Median
diff	15	12	65.5	0.021	1.500

## Standard Normal Distribution

z	P( 0 ≤ Z ≤ z )									
	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	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
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

## Student's t distribution

**Table shows t critical values for right-tailed probabilities**

<b>d.f.</b>	<b>0.250</b>	<b>0.200</b>	<b>0.150</b>	<b>0.100</b>	<b>0.075</b>	<b>0.050</b>	<b>0.030</b>	<b>0.025</b>	<b>0.010</b>	<b>0.005</b>	<b>0.001</b>
1	1.00	1.38	1.96	3.08	4.17	6.31	10.58	12.71	31.82	63.66	318.31
2	0.82	1.06	1.39	1.89	2.28	2.92	3.90	4.30	6.96	9.92	22.33
3	0.76	0.98	1.25	1.64	1.92	2.35	2.95	3.18	4.54	5.84	10.21
4	0.74	0.94	1.19	1.53	1.78	2.13	2.60	2.78	3.75	4.60	7.17
5	0.73	0.92	1.16	1.48	1.70	2.02	2.42	2.57	3.36	4.03	5.89
6	0.72	0.91	1.13	1.44	1.65	1.94	2.31	2.45	3.14	3.71	5.21
7	0.71	0.90	1.12	1.41	1.62	1.89	2.24	2.36	3.00	3.50	4.79
8	0.71	0.89	1.11	1.40	1.59	1.86	2.19	2.31	2.90	3.36	4.50
9	0.70	0.88	1.10	1.38	1.57	1.83	2.15	2.26	2.82	3.25	4.30
10	0.70	0.88	1.09	1.37	1.56	1.81	2.12	2.23	2.76	3.17	4.14
11	0.70	0.88	1.09	1.36	1.55	1.80	2.10	2.20	2.72	3.11	4.02
12	0.70	0.87	1.08	1.36	1.54	1.78	2.08	2.18	2.68	3.05	3.93
13	0.69	0.87	1.08	1.35	1.53	1.77	2.06	2.16	2.65	3.01	3.85
14	0.69	0.87	1.08	1.35	1.52	1.76	2.05	2.14	2.62	2.98	3.79
15	0.69	0.87	1.07	1.34	1.52	1.75	2.03	2.13	2.60	2.95	3.73
16	0.69	0.86	1.07	1.34	1.51	1.75	2.02	2.12	2.58	2.92	3.69
17	0.69	0.86	1.07	1.33	1.51	1.74	2.02	2.11	2.57	2.90	3.65
18	0.69	0.86	1.07	1.33	1.50	1.73	2.01	2.10	2.55	2.88	3.61
19	0.69	0.86	1.07	1.33	1.50	1.73	2.00	2.09	2.54	2.86	3.58
20	0.69	0.86	1.06	1.33	1.50	1.72	1.99	2.09	2.53	2.85	3.55
21	0.69	0.86	1.06	1.32	1.49	1.72	1.99	2.08	2.52	2.83	3.53
22	0.69	0.86	1.06	1.32	1.49	1.72	1.98	2.07	2.51	2.82	3.50
23	0.69	0.86	1.06	1.32	1.49	1.71	1.98	2.07	2.50	2.81	3.48
24	0.68	0.86	1.06	1.32	1.49	1.71	1.97	2.06	2.49	2.80	3.47
25	0.68	0.86	1.06	1.32	1.49	1.71	1.97	2.06	2.49	2.79	3.45
26	0.68	0.86	1.06	1.31	1.48	1.71	1.97	2.06	2.48	2.78	3.43
27	0.68	0.86	1.06	1.31	1.48	1.70	1.96	2.05	2.47	2.77	3.42
28	0.68	0.85	1.06	1.31	1.48	1.70	1.96	2.05	2.47	2.76	3.41
29	0.68	0.85	1.06	1.31	1.48	1.70	1.96	2.05	2.46	2.76	3.40
30	0.68	0.85	1.05	1.31	1.48	1.70	1.95	2.04	2.46	2.75	3.39
31	0.68	0.85	1.05	1.31	1.48	1.70	1.95	2.04	2.45	2.74	3.37
32	0.68	0.85	1.05	1.31	1.47	1.69	1.95	2.04	2.45	2.74	3.37
33	0.68	0.85	1.05	1.31	1.47	1.69	1.95	2.03	2.44	2.73	3.36
34	0.68	0.85	1.05	1.31	1.47	1.69	1.95	2.03	2.44	2.73	3.35
35	0.68	0.85	1.05	1.31	1.47	1.69	1.94	2.03	2.44	2.72	3.34
36	0.68	0.85	1.05	1.31	1.47	1.69	1.94	2.03	2.43	2.72	3.33
37	0.68	0.85	1.05	1.30	1.47	1.69	1.94	2.03	2.43	2.72	3.33
38	0.68	0.85	1.05	1.30	1.47	1.69	1.94	2.02	2.43	2.71	3.32
39	0.68	0.85	1.05	1.30	1.47	1.68	1.94	2.02	2.43	2.71	3.31
40	0.68	0.85	1.05	1.30	1.47	1.68	1.94	2.02	2.42	2.70	3.31
50	0.68	0.85	1.05	1.30	1.46	1.68	1.92	2.01	2.40	2.68	3.26
100	0.68	0.85	1.04	1.29	1.45	1.66	1.90	1.98	2.36	2.63	3.17
200	0.68	0.84	1.04	1.29	1.45	1.65	1.89	1.97	2.35	2.60	3.13