QMS 102 PRACTICE FINAL EXAM

Student Resource Centre

Ted Rogers School of Management

Disclaimer: Please note that this is NOT an actual test/exam given in the past by instructors at the Ted Rogers School of Management. As a student, you may use this test/exam to gauge your preparation before taking a final exam. You should **NOT** assume that the QMS 102 final exam will resemble any of the sample questions provided here.

While you will only be marking yourself, keep in mind that marks on a real exam are not awarded without full supporting calculations.

The exam is best used by writing it under simulated exam conditions. This exam was designed to take **3 hours** to complete, and solutions will be provided.

Good Luck!

QUESTION #1

What level of measurement is the Centigrade temperature scale?

A. Nominal B. Ordinal C. Ratio- discrete D. Ratio-continuous
E. Interval-discrete F. Interval-continuous

What level of measurement is a bar code?

A. Nominal B. Ordinal C. Ratio- discrete D. Ratio-continuous
E. Interval-discrete F. Interval-continuous

QUESTION #2

The following table shows some data regarding the top 5 chains of toy stores.
For the chains and stores in this table:

Chain	# of Stores	Average Sales/ Store ($000)
Toy 'R' Us	140	7240
Child World	70	3560
Kay bee	360	520
Lionel	56	860
Ryerson	60	40

a. Determine the mean sales per chain

b. Determine the mean sales per store

QUESTION #3

Ryerson Property Corporation

City	% Rent Increase Over Next 3 Years	# of Buildings	Average Building size (square feet)	Total # of Apartment Units	Current Total Rent($)
A	2	5	136,000	420	1,250,000
B	1	3	110,000	120	250,000
C	3	2	45,800	140	380,700
D	2	1	120,500	200	450,650
E	2	0	-	-	-
F	1	4	75,000	140	185,950
G	2	0	-	-	-
H	2	2	100,000	98	120,000

Ryerson Property Corporation owns several buildings in various cities. Each building has apartment units, which can be rented out.

a. What is the average size of a building?

b. What is the overall average rent per square foot of building space for Ryerson Property Corporation?

c. What is the overall average amount of space per apartment unit in Ryerson Corporation buildings?

d. What is the average number of apartment units in the Ryerson Property Corporation building?

QUESTION #4

Consider the following data

9, 11, 14, 19, 22, 26, 32

Determine the

a. first quartile b. 30^{th} percentile c. second quartile

d. 60^{th} percentile e. third quartile f. 90^{th} percentile

QUESTION #5

The following table shows data for houses that are being built on a short street in a new subdivision

House Number	Size Square ft.	Price($000's)
6001	2500	279
6002	2750	299
6003	2300	235
6004	2250	228
6005	2600	248

a. Compute the sample mean and standard deviation size of a house

b. Compute the sample mean and standard deviation price of a house

c. Compare the variability of the size and the price

QUESTION #6

The Ryerson Bank is studying the number of times the ATM, located in Metro Store, is used per day. Following are the number of times the machine was used over each of the last 30 days.

26	28	80	81	82	82	83	84	85	85
86	87	87	87	88	88	89	90	90	90
90	91	91	91	103	110	130	138	155	174

a. Determine

i. Minimum value _____ ii. Maximum value _____

iii. Range _____ iv. Sample mean _____

v. First quartile _____ vi. Third quartile _____

vii. Median _____ viii. interquartile range _____

b. Determine the

i. Left inner fence

ii. Right inner fence

c. i. The smallest value of the left whisker is _____

ii. The largest value of the right whisker is _____

d. Determine the
i. Left outer fence
ii. Right outer fence

e. Determine the suspect outliers

f. Determine the outliers

QUESTION #7

A fast food company plans to install a new ice-cream dispensing unit in one of the two store locations. The company figures that the probability of a unit being successful in location A is 5/8 and the annual profit in this case is $185,000. If it is not successful there will be losses of $36,800. At the location B the probability of succeeding is ½ but the potential profit and loss are $250,000 and $58,000 respectively.

a. Where should the company locate to maximize expected profit?
b. Which location is less risky, i.e has the lowest relative variability?

QUESTION #8

The normal weekly demand of a certain perishable product sold by Ryerson Inc. is given by the following distribution

Demand	21	22	23	24	25
Probability	0.4	0.2	0.2	0.1	0.1

The product costs Ryerson $9 each. The product sells for $16 each. If not sold by the end of the week, the leftover units must be scrapped.

The supplier only has 23, 24 or 25 units for Ryerson to purchase. How many would you recommend Ryerson to purchase based on expected profit?

QUESTION #9

According to Ryerson survey, 30% of adults in Toronto said that the cell phone is the invention that they hate most but cannot live without. Suppose this result holds true for the current population of adults in Toronto. A random sample of 80 adults is selected. Determine the probability that

a. exactly twenty adults in this sample hold the said opinion.
b. atmost twenty-five adults in this sample hold the said opinion.
c. at least fifteen adults in this sample hold the said opinion.

QUESTION #10

A fast food chain store conducted a taste survey before marketing a new hamburger. The results of the survey showed that 70% of the people who tried this hamburger liked it. Encouraged by this result, the company decided to market the new hamburger. Assume that 70% of all people like this hamburger. On a certain day, sixty customers bought it for the first time.

a. Define the random variable X
b. What is the probability that

i. exactly forty of the customers will like this hamburger?
ii. less than thirty-five customers will like this hamburger?
iii. At least thirty-five of the customers will like this hamburger?

c. Determine the mean and the standard deviation of the sixty customers that will like this hamburger.

QUESTION #11

At the Express Business Delivery Service, providing high-quality service to customers is the top priority of management. The company guarantees a refund of all charges if a package it is delivering does not arrive at its destination by a specified time. It is known from past data that despite all efforts, 2% of the packages mailed through this company do not arrive at their destinations within the specified time. Suppose a corporation mails 400 packages through Express Business Delivery Service on a certain day.

a. Define the random variable X
b. Determine the probability that
i. exactly five of these 400 packages will not arrive at its destination within the specified time
ii. at most nine of these 400 packages will not arrive at its destination within the specified time.
iii. between five and twelve packages(inclusive) will not arrive at its destination within the specified time.

QUESTION #12

Bankruptcies of convenience stores in Toronto occur randomly at an average rate of 4.8 per year. Determine the probability that there will be:

a. at most 3 convenience store bankruptcies this year
b. no convenience store bankruptcies in the next three months
c. exactly two convenience store bankruptcies in the next six months
d. exactly seven convenience store bankruptcies in the next two years.

QUESTION #13

A data entry typist makes an average of 3 errors per page. If the errors occur randomly, what is the probability that:

a. there will be two errors on the next page?
b. there will be more than 5 errors on the next two pages?
c. there will be less than 5 errors on the next two pages?
d. there will be at least 5 errors on the next three pages?

QUESTION #14

Let x be a normal random variable with its mean equal to 40 and standard deviation equal to 5. Determine the following probabilities:

a. P $(x \geq 50)$ b. P $(x < 47)$ c. P $(42 \leq x \leq 49)$

QUESTION #15

a. What is the area under the normal curve between $z = -2.34$ and $z = -1.45$?

b. What is the area under the normal curve between $z = -9.0$ and $z = 0$?

c. Determine i. $P(-1.45 \leq z \leq 2.06)$ ii. $P(z \geq -1.47)$

QUESTION #16

The recent average starting salary for new college graduates in marketing is $38,000. Assume salaries are normally distributed with a standard deviation $3500.

a. Define the random variable X

b. Determine the probability of a new graduate receiving a salary of

i.more than $39,000 ii.less than $45,000 iii.. between $35,000 and $40,000

iv.between $$38,000 and $46,000

QUESTION #17

Ryerson Trucking Company determined that on an annual basis the distance traveled per truck is normally distributed with a mean of 54.6 thousand miles and a standard deviation of 11.8 thousand miles.

a. What percentage of trucks can be expected to travel either below 32 or above 65 thousand miles in the tear?
b. How many miles will be traveled by at least 70% of the truck?
c. How many miles will be traveled by at most 85% of the truck?

QUESTION #18

An orange juice producer buys all his oranges from a large grove. The amount of juice squeezed from each of these oranges is approximately normally distributed with a mean of 4.86 ounces and a standard deviation of 0.37 ounce.

a. 85% of the oranges will contain at least how many ounces of juice?
b. 78% of the oranges will contain at most how many ounces of juice?
c. 90% of the oranges are between what two values (in ounces) symmetrically distributed around the population mean?

QUESTION #19

Matthew, an executive at Ryerson Inc. drives from his home in the suburbs near City A to his office in the center of the city. The driving times are normally distributed with a mean of 37 minutes and a standard deviation of 9 minutes.

a. Determine the probability of the days that he will take

i. 46 minutes or more to drive to work,
ii. between 39 to 54 minutes to drive to work
iii. within 10 mins of the mean

b. Some days there will be accidents or other delays, so the trip will take longer than usual. How long will the longest 6 percent of the trip take?

QUESTION #20

A survey indicates that a shopper spends an average of 43 minutes with a variance of 100 minutes^2 in the store. The length of time spent in the store is normally distributed.

a. What is the probability that the shopper will be in the store between 35 minutes and 1 hour?

b. If there are 85 shoppers entering in the store, what is the probability that more than 12 will be in the store for less than half an hour?

c. If there are 100 shoppers entering in the store, how many would you expect for them to be in the store for more than 65 minutes?

QUESTION #21

The balances of all savings accounts in Ryerson Bank at Yonge and Dundas have an unknown distribution with its mean equal to $12450 and standard deviation equal to $4200. Determine the probability that the mean balance of a sample of 49 saving accounts selected from this bank will be

a. more than $11,500 b. between $12,000 and $13,800
c. within $1500 of the population mean
d. more than the population mean by at least $1000

QUESTION #22
A company is concerned about a particular measurement. The results of 24 samples of 5 items are shown below.

Sample results

Sample	Item 1	Item 2	Item 3	Item 4	Item 5	Mean	Range
1	10.65	10.70	10.65	10.65	10.85	10.70	0.20
2	10.75	10.85	10.75	10.85	10.65	10.77	0.20
3	10.75	10.80	10.80	10.70	10.75	10.76	0.10
4	10.60	10.70	10.70	10.75	10.65	10.68	0.15
5	10.70	10.75	10.65	10.85	10.80	10.75	0.20
6	10.60	10.75	10.75	10.85	10.70	10.73	0.25
7	10.60	10.80	10.70	10.75	10.75	10.72	0.20
8	10.75	10.80	10.65	10.75	10.70	10.73	0.15
9	10.65	10.80	10.85	10.85	10.75	10.78	0.20
10	10.60	10.70	10.60	10.80	10.65	10.67	0.20
11	10.80	10.75	10.90	10.50	10.85	10.76	0.40
12	10.85	10.75	10.85	10.65	10.70	10.76	0.20
13	10.70	10.70	10.75	10.75	10.70	10.72	0.05
14	10.65	10.70	10.85	10.75	10.60	10.71	0.25
15	10.75	10.80	10.75	10.80	10.65	10.75	0.15
16	10.90	10.80	10.80	10.75	10.85	10.82	0.15
17	10.75	10.70	10.85	10.70	10.80	10.76	0.15
18	10.75	10.70	10.60	10.70	10.60	10.67	0.15
19	10.65	10.65	10.85	10.65	10.70	10.70	0.20
20	10.55	10.55	10.60	10.50	10.60	10.56	0.10
21	10.50	10.55	10.65	10.80	10.80	10.66	0.30
22	10.80	10.65	10.75	10.65	10.65	10.70	0.15
23	10.65	10.60	10.65	10.60	10.70	10.64	0.10
24	10.65	10.70	10.70	10.60	10.65	10.66	0.10

Determine the X-bar and R chart control limits. If any sample results are out-of-control assume an assignable cause can be found and make the necessary adjustments to the control chart values.

ANSWERS

Q1

(a) F

(b) A; Numbers can be used as tags or labels, where the size of the number is arbitrary. Barcode is an example of that

Q2

(a)

$$\frac{\text{Total}}{5} = \frac{1{,}500{,}560{,}000}{5} = 300{,}112{,}000$$

(b)

Average sales = X (The variable we are interested in); LIST 1
Number of stores = Weight; LIST 2
Mean = 2,187,405.24

Q3

(a)

Average: 101300

(b)

$$\frac{\text{Total Rent}}{\text{Total Size}} = \frac{2637300}{1722100} = \$1.53$$

(c)

$$\frac{\text{Total Size}}{\text{Total No. of Apartments}} = \frac{1722100}{1118} = 1540.34$$

(d)

$$\frac{\text{Total \# of apartments}}{\text{Total \# of buildings}} = \frac{1118}{17} = 65.76$$

Q4

a) R25 = Half Round $\left[n\frac{k}{100}+\frac{1}{2}\right]$

= Half Round $\left[7\frac{25}{100}+\frac{1}{2}\right]$

= 2.25 = 2nd

Therefore **P25 = 11**

b) R30 = Half Round $\left[n\frac{k}{100}+\frac{1}{2}\right]$

= Half Round $\left[7\frac{30}{100}+\frac{1}{2}\right]$

= 2.5

2nd = 11

3rd = 14

P30 = (11+14) / 2 = 12.5

Similarly, we calculate the answers for the further steps

c) 11
d) 20.5
e) 26
f) 32

Q5

a. $\bar{x} = 2480$ square ft. , $s = 207.966$ square feet

b. $\bar{x} = \$257800$, $s = \$30211$

c. Size $CV = \frac{s}{\bar{x}} \times 100\% = \frac{207.966}{2480} \times 100\% = 8.386\% = 8.4\%$

Price $CV = \frac{s}{\bar{x}} \times 100\% = \frac{\$30211}{\$257800} \times 100\% = 11.719\% = 12\%$

The prices are relatively more variable

Q6

a)
i) 26 ii) 174 iii) 148 iv) 92.3667 v) 84 vi) 91 vii) 88 viii) 7
b)
i) 73.5 ii) 101.5
c)
i) 80 ii) 91
d)
i) 63 ii) 112
e) 103, 110
f) 26, 28, 130, 138, 155, 174

Q7

a) Location A

P(x)	X
5/8	185,000
3/8	-36,800

Expected Profit = 101,825

Location B

P(x)	X
½	250,000
½	-58,000

Expected Profit = 96,000

The company should locate the machines at Location A, It has higher expected profit

b) Location A
SD = 107,378.463
CV = 1.05

Location B
SD = 154,000
CV = 1.60

CV of Location A < CV of Location B
Location A is less risky (Lowest relative variability)

Q8

23 units

Demand	Profit	P(X)
21	21(16) – 23(9) = $129	0.4
22	22(16) – 23(9) = $145	0.2
23	23(16) – 23(9) = $161	0.2
24	23(16) – 23(9) = $161	0.1
25	23(16) – 23(9) = $161	0.1

Expected Value = $145

24 units

Demand	Profit	P(X)
21	21(16) – 24(9) = $120	0.4
22	22(16) – 24(9) = $136	0.2
23	23(16) – 24(9) = $152	0.2
24	24(16) – 24(9) = $168	0.1
25	24(16) – 24(9) = $168	0.1

Expected Value = $139.2

25 units

Demand	Profit	P(X)
21	21(16) – 25(9) = $111	0.4
22	22(16) – 25(9) = $127	0.2
23	23(16) – 25(9) = $143	0.2
24	24(16) – 25(9) = $159	0.1
25	25(16) – 25(9) = $175	0.1

Expected Value = $131.8
23 units are recommended to maximize profit

Q9

a) N = 80
P = 0.3
X = 20
P(X = 20) = 0.0626

b) X ≤ 25
P (X ≤ 25) = 0.64794

c) $X \geq 15$
$P(X \geq 15) = 1 - P(X \leq 14) = 1 - 0.0079347 = 0.99207$

Q10
N = 60
P = 0.7
a) X is Number of customers who will like the hamburgers.
b) I) $P(X = 40)$
$=0.09306$
ii) $P(X < 35) = P(X \leq 34)$
$= 0.01957$
iii) $P(X \geq 35) = 1 - P(X \leq 34)$
$= 1 - 0.01957428$
$= 0.98042572$
c) Mean = np = 42
SD = sqrt(npq)
= sqrt(np{1-p})
= sqrt{60(0.7)(0.3)}
= 3.55

Q11
N = 400
P = 0.02
Let X be the # of packages will not arrive at its destination within the specified time.
i) $P(X=5) = 0.09113$
ii) $P(X \leq 9) = 0.7189$
iii) $P(5 \leq X \leq 12) = P(X \leq 12) - P(X \leq 4) = 0.93814 - 0.09733 = 0.84081$

Q12
a) $P(X \leq 3) = 0.29422$
b) $P(X = 0) = 0.30119$
c) $P(X = 2) = 0.2612677$
d) $P(X = 7) = 0.10098$

Q13
a) $P(X = 2) = 0.22404$
b) $P(X > 5) = 1 - P(X \leq 5) = 1 - .44567964 = 0.55432$
c) $P(X < 5) = P(X \leq 4) = 0.2850565$
d) $P(X \geq 5) = 1 - P(X \leq 4) = 1 - 0.05496 = 0.94504$

Q14
Mean = 40
SD = 5
a) $P(X \geq 50)$
Lower Value = 50
Upper Value = 10000000…
$P(X \geq 50) = 0.02275013$
b) $P(X < 47)$
Upper = 47
Lower = -10000000…

P(X < 47) = 0.91924334

c) P(42 ≤ X ≤ 49)
Upper = 49
Lower = 42
P(42 ≤ X ≤ 49) = 0.30864793

Q15

Mean = 0 ; SD = 1

a) P(-2.34 ≤ Z ≤ -1.45)
P = 0.06388738

b) P(-9 ≤ Z ≤ 0)
P = 0.5

c) I) $P(-1.45 \leq z \leq 2.06)$ = 0.90677147
Ii) $P(z \geq -1.47)$ = 0.92921912

Q16

Mean = 38000
SD = 3500
Let X be the starting salary for new college graduates in marketing

I) P(X > 39000) = 0.38755
II) P(X < 45000) = 0.97724
III) P(35000 ≤ X ≤ 40000) = 0.52046
IV) P(38000 ≤ X ≤ 46000) = 0.48886\

Q17

Mean = 546000
SD = 118000

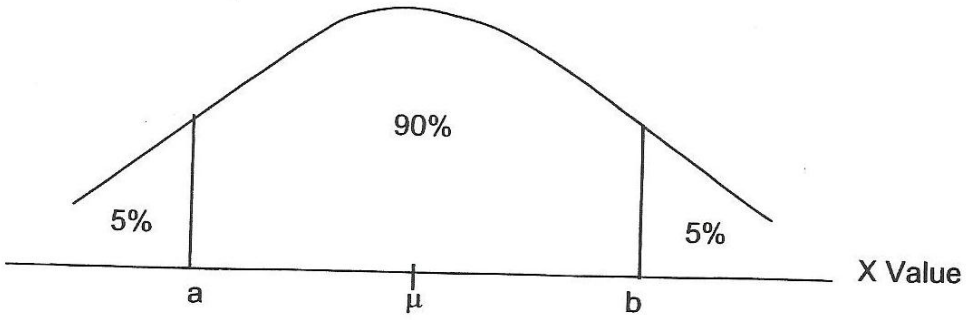
a) P(X<32) + P(X>65)
P(X<32) = 0.02773004
P(X>65) = 0.1890626
P(X<32) + P(X>65) = 0.21679264

b) P(X ≥ a) = 0.7 (We use Inverse)
Tail: Right
Area = 0.7
a = 48.412074
P(X > **48.412074**) = 0.7

c) P(X ≤ b) = 0.85
Tail: Left
Area = 0.85

b = 66.83
P(X < **66.83**) = 0.85

Q18



Mean = 4.86
SD = 0.37

a) $P(X \geq a) = 0.85$
Tail: Right
Area = 0.85

a = 4.476

b) $P(X \leq b) = 0.78$
Tail: Left
Area = 0.78

b = 5.1457

c) $P(a \leq X \leq b) = 0.9$
Tail: Central
Area = 0.9

a = 4.2514
b = 5.4686

Q19

a) I) $P(X \geq 46) = 0.15866$
ii) $P(39 \leq X \leq 54) = 0.38262$
iii) $P(27 \leq X \leq 47) = 0.7335$

b) $P(X > a) = 0.06$
Tail = Right
Area = 0.06
A = 50.993

Q20

(a)

SD = 10
$P(35 \leq X \leq 60) = 0.74358$

(b)

$P(X < 30) = 0.0968$ [Normal Distribution is used to calculate the number of people remaining in the store for less than half an hour]

$P(X>12) = 1 - P(X \leq 12) = 1 - 0.9348 = 0.0652$ [The Binomial Distribution is used to calculate probability of more than 12 people in store for less than half hour i.e. 0.0968]

(c)

$P(X > 65) = 0.0139$ (Normal Distribution)
Expected Value = Mean = np = E(X) = 100 X 0.0139 = 1.39

Q21

(a) 0.9433
(b) 0.7611
(c) 0.9876
(d) 0.0478

Q22

K = 24
N = 5

R bar = 4.3 / 24 = 0.1792
UCL_R = 2.114 X 0.1792 = 0.3788
LCL_R = 0

Sample 11 is out of control

So,
K = 23
N = 5
R bar = 3.9 / 23 = 0.1696

UCL_R = 0.1696 X 3.9 = 0.359
LCL_R = 0

No out of control

$\bar{X}^2$ = 246.4 / 23 = 10.713

UCL_X = 10.713 + 0.09785 = 10.8109
LCL_X = 10.713 – 0.09785 = 10.6152

#16, #20 is out of control

R bar = 3.65/21 = 0.174
UCL_R = 2.114 X 0.174 = 0.3678
LCL_R = 0

$\bar{X}^2$ = 225.02 / 21 = 10.715
UCL_X = 10.715 + 0.1004 = 10.815
LCL_X = 10.715 – 0.1004 = 10.615

No out of control