DeVry College of Technology — Spring 2004

Math 191: Probability & Statistics Exam #1 Solutions

Week #7

(1) The order of the answers is

(a) A
(b) B and C
(c) O
(d) M
(e) F

(a) I
(b) O
(c) G and J
(d) N
(e) H

(a) D
(b) N
(c) H
(d) E
(e) O

(2) Solving this problem involves constructing multiple tables and drawing a line graph.

(a) The table for this portion of the problem. You list the five classes and there matching frequencies. For convenience, I'm also including the relative frequencies.

Class	**Freq.**	Rel.
102.5-134.5	2	7.7%
134.5-166.5	3	11.5%
166.5 - 198.5	13	50%
198.5 - 230.5	3	11.5%
230.5-262.5	5	19.2%

Class	**Freq.**	Rel.
148.5 - 168.5	6	23%
168.5 - 188.5	3	11.5%
188.5 - 208.5	7	27%
208.5 - 228.5	4	15%
228.5 - 248.5	6	23%

Class	**Freq.**	Rel.
136.5 - 168.5	5	19%
168.5-200.5	10	38%
200.5 - 2332.5	6	23%
232.5 - 264.5	3	11.5%
264.5 - 296.5	2	7.7%

(b) I'm not drawing the polygons. Sorry!

(c) To estimate the mean $\overline{x}$ and standard deviation s, you use the following tables and formulas.

x	f	xf	x^2f
118.5	2	237	28084.5
150.5	3	451.5	67950.75
182.5	13	2372.5	432981.25
214.5	3	643.5	138030.75
246.5	5	1232.5	303811.25
	26	4937	970858.5

$$\overline{x} = \frac{4937}{26} = 189.9$$
$$s^2 = \frac{26(970858.5) - (189.9)^2}{26(25)} = 1335.93$$
$$s = \sqrt{1335.93} = 36.55$$

x	f	xf	x^2f
158.5	6	951	150733.5
178.5	3	535.5	95586.75
198.5	7	1389.5	275815.75
218.5	4	874	190969
238.5	6	1431	341293.5
	26	5181	1054398.5

$$\overline{x} = \frac{5181}{26} = 199.3$$
$$s^2 = \frac{26(1054398.5) - (199.3)^2}{26(25)} = 879.4$$
$$s = \sqrt{879.4} = 29.65$$

x	f	xf	x^2f
152.5	5	762.5	116281.25
184.5	10	1845	340402.5
216.5	6	1299	281233.5
248.5	3	745.5	185,256.75
280.5	2	561	157360.5
	26	5213	1080534.5

$$\overline{x} = \frac{5213}{26} = 200.5$$
$$s^2 = \frac{26(1080534.5) - (200.5)^2}{26(25)} = 1413.12$$
$$s = \sqrt{1413.12} = 37.59$$

In reality, the actual values are

$$\overline{x} = 190.4, \quad s^2 = 1448.6, \quad s = 38.1$$

$$\overline{x} = 198.7, \quad s^2 = 913.5, \quad s = 30.2$$

$$\overline{x} = 199.5, \quad s^2 = 1542.4, \quad s = 39.3$$

(3) To solve this problem, you first must sort the stock prices from lowest to highest. Then, the maximum and minimum values are obvious. To find the median of 10 values, take $\frac{10+1}{2} = 5.5$ which indicates the average of the 5th and 6th values. To find Q_1, take the $10(.25) = 2.5 \rightarrow$ 3rd value. Similarly, Q_3 is the $10(.75) = 7.5 \rightarrow$ 8th value. For each version, this gives

8,11,15,22,22,29,33,35,38,74

Min	8
Q1	15
Median	$\frac{22+29}{2} = 25.5$
Q3	35
Max	74

$$\begin{aligned} \text{Int.quartile} &= 35 - 15 = 20 \\ \text{Midhinge} &= \frac{15+35}{2} = 25 \end{aligned}$$

8,12,15,22,29,30,33,38,57,70

Min	8
Q1	15
Median	$\frac{22+29}{2} = 29.5$
Q3	38
Max	70

$$\begin{aligned} \text{Int.quartile} &= 38 - 15 = 23 \\ \text{Midhinge} &= \frac{15+38}{2} = 26.5 \end{aligned}$$

8,12,15,22,29,32,33,34,42,57

Min	8
Q1	15
Median	$\frac{29+32}{2} = 30.5$
Q3	34
Max	57

$$\begin{aligned} \text{Int.quartile} &= 34 - 15 = 19 \\ \text{Midhinge} &= \frac{15+34}{2} = 24.5 \end{aligned}$$

(4) In this example, you are first selecting a group of any type of battery without regard to whether it's defective. For the last two parts, consider the group of working batteries. There are one less than the total. To pick the defective one, select one less from the smaller group. To pick only working batteries, select the same number of batteries from the smaller group. For each version, this gives

$n = 10$

$k = 3$

a. $\binom{10}{3} = 120$

b. $\binom{10-1}{3-1} = \binom{9}{2} = 36$

c. $\binom{10-1}{3} = \binom{9}{3} = 84$

$n = 11$

$k = 4$

a. $\binom{11}{4} = 330$

b. $\binom{11-1}{4-1} = \binom{10}{3} = 120$

c. $\binom{11-1}{4} = \binom{10}{4} = 210$

$n = 13$

$k = 5$

a. $\binom{13}{5} = 1287$

b. $\binom{13-1}{5-1} = \binom{12}{4} = 495$

c. $\binom{13-1}{5} = \binom{12}{5} = 792$

(5) Let A represent the probability of watching one of the programs, and B the probability of watching the second program. You compute each probability by determining the number of households that watched (or did not watch) and dividing by the total number of TV households. For each version, this gives

A = American Idol

B = Without A Trace

a. $P(A) = \frac{23.5}{108.4}$ $= 21.68\%$

b. $P(\text{both}) = \frac{7.3}{108.4}$ $= 6.734\%$

c. $P(\text{not } A) = 1 - \frac{13.8}{108.4}$ $= 87.27\%$

d. $P(A \text{ or } B)$ $= \frac{23.5 + 13.8 - 7.3}{108.4}$ $= 27.68\%$

A = The Apprentice

B = CSI

a. $P(A) = \frac{22.0}{108.4}$ $= 20.30\%$

b. $P(\text{both}) = \frac{8.6}{108.4}$ $= 7.934\%$

c. $P(\text{not } A) = 1 - \frac{19.5}{108.4}$ $= 82.01\%$

d. $P(A \text{ or } B)$ $= \frac{22.0 + 19.5 - 8.6}{108.4}$ $= 30.35\%$

A = E.R.

B = Law and Order

a. $P(A) = \frac{20.0}{108.4}$ $= 18.45\%$

b. $P(\text{both}) = \frac{6.9}{108.4}$ $= 6.365\%$

c. $P(\text{not } A) = 1 - \frac{13.3}{108.4}$ $= 87.73\%$

d. $P(A \text{ or } B)$ $= \frac{20.0 + 13.3 - 6.9}{108.4}$ $= 24.35\%$