

# Math 191: Probability & Statistics Assignment A

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
296	359	300	363	412	309	426	441	430	215
286	378	394	525	463	212	194	371	424	218
372	324	252	460	335	390	450	315	293	463
312	372	353	471	386	557	414	415	405	290
411	429	331	374	175	181	311	426	305	407
452	258	462	253	284	409	335	272	111	511

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
301	316	302	333	178	458	371	136	104	167
349	514	320	359	260	326	238	290	376	242
230	177	206	320	405	356	395	85	110	251
302	310	257	143	492	356	206	234	366	288
188	339	242	216	272	134	266	45	183	430

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment B

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
346	416	312	441	476	381	405	490	483	474
363	459	466	219	343	253	364	331	262	250
398	204	242	407	354	456	360	375	372	317
575	386	323	396	338	313	370	277	329	283
412	366	286	422	474	295	278	419	400	287
312	419	436	454	462	414	386	249	389	362

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
304	196	90	215	337	260	610	333	154	210
400	132	245	362	492	293	6	210	282	226
499	81	237	47	345	473	44	243	364	447
266	357	318	331	5	42	437	52	489	99
226	339	312	339	235	78	345	314	226	181

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment C

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
501	343	448	217	193	582	275	346	295	316
415	422	395	365	385	231	465	293	325	252
177	313	256	338	432	274	334	272	201	492
327	338	493	497	246	361	340	249	350	379
327	225	441	390	492	297	383	454	309	336
363	248	414	246	503	428	298	395	369	470

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
254	430	190	331	211	326	266	425	100	206
320	261	80	256	203	64	210	258	78	194
297	430	210	149	305	93	237	124	572	25
112	200	243	116	322	84	283	185	212	283
241	481	152	209	264	255	596	185	282	234

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment D

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
159	260	293	360	672	344	326	293	281	633
201	411	343	466	322	442	499	322	380	345
467	440	300	374	259	341	339	550	279	592
304	570	188	281	228	297	314	328	263	388
386	183	399	323	403	305	568	304	251	274
212	279	507	362	430	266	260	352	278	308

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
62	360	291	414	242	193	59	218	293	210
332	87	318	358	389	365	356	250	503	373
309	395	216	402	54	530	149	253	327	191
183	19	370	523	254	241	203	457	354	244
379	234	368	282	385	181	166	297	25	353

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment E

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
311	419	259	341	420	545	212	601	367	472
352	228	413	393	262	357	348	380	333	500
206	578	367	402	198	216	315	418	276	481
230	413	464	398	239	352	341	533	533	567
450	350	300	361	276	171	314	327	413	492
531	384	316	248	397	159	166	418	310	178

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
126	526	213	443	343	393	208	476	400	8
449	23	203	264	194	329	347	369	301	256
209	238	229	206	5	314	112	234	240	160
433	477	197	171	202	143	354	196	215	255
385	286	248	285	96	92	341	408	250	152

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment F

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
509	463	588	403	242	329	305	372	431	453
169	109	385	392	340	350	474	508	437	276
404	322	515	408	393	468	459	423	397	476
434	444	490	367	349	394	430	406	375	398
517	420	504	502	454	454	356	480	456	457
357	338	467	460	452	428	244	328	395	202

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
155	36	28	66	68	344	280	220	235	250
254	93	83	295	457	403	211	109	221	358
148	570	171	296	235	146	164	309	333	212
162	119	348	50	410	218	106	316	347	225
351	442	115	204	92	1	250	213	366	240

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment G

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
390	259	332	293	321	140	588	378	110	485
450	488	292	256	235	316	406	350	507	227
308	119	438	298	432	291	352	122	434	200
241	375	403	491	345	389	225	338	419	388
494	333	348	375	621	604	407	292	354	558
414	378	403	483	448	453	407	401	257	338

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
111	462	429	262	140	101	387	287	291	228
176	35	297	306	236	346	311	252	202	363
155	159	317	396	434	351	514	344	314	306
366	530	456	174	54	291	142	129	279	497
217	262	273	396	304	301	232	264	66	331

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment H

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
457	310	528	501	275	169	487	253	340	212
162	269	305	328	357	271	338	281	310	386
366	305	331	461	388	240	407	458	378	338
300	490	362	421	522	361	400	226	365	333
499	74	356	396	243	270	426	198	413	439
392	353	256	363	378	290	267	209	377	512

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
240	174	81	54	412	246	215	112	191	192
501	395	330	238	450	200	330	118	139	84
355	417	301	6	106	262	414	368	176	569
284	17	107	442	194	461	377	263	170	393
52	188	202	21	124	231	84	233	312	279

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment I

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
238	364	295	438	261	214	313	421	391	274
427	370	360	357	213	184	274	215	353	583
280	468	324	386	504	372	366	323	409	243
582	217	428	353	334	546	404	436	500	424
370	357	224	469	357	162	172	286	306	578
311	365	230	210	368	510	305	344	343	255

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
358	80	190	366	161	322	380	321	302	285
97	209	363	211	327	240	209	226	71	400
570	132	221	138	345	311	202	125	235	127
138	232	154	156	407	168	201	578	197	246
404	343	334	254	338	300	100	257	321	379

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?

# Math 191: Probability & Statistics Assignment J

Weeks #11-12

**Title:** Confidence interval estimation of the mean (when the standard deviation is known and when it is unknown)

**Objectives:**

- To determine confidence interval estimates for the mean using Excel functions and formulas.
- To present a business application that uses confidence interval estimates.

**Directions:**

- Review the instructions on pp.282-286, pp.291-294, and pp.299-303 including the boxed formulas and examples. In addition, see the problems at the end of section 7.2 and their solutions for additional assistance.
  - Beyond basic arithmetic, you may need to use the following Excel formulas: AVERAGE, STDEV, SQRT, NORMDIST, NORMINV, CONFIDENCE, and TINV.
  - Supply all of your answers to this lab on an Excel spreadsheet that includes your name, course number and section, and data set letter.
- (1) The quality control manager at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation **is known to be 100 hours**. A random sample of 60 light bulbs is shown below. (We assume that the average life of a light bulb is normally distributed.)

Light Bulb Lives									
672	192	318	269	167	485	346	358	405	398
207	469	309	439	295	430	345	339	316	274
341	419	409	451	508	317	108	329	247	227
301	481	290	405	588	373	513	357	422	535
336	392	365	352	410	228	361	356	253	500
459	201	252	396	341	442	372	375	643	271

- Determine the average life of the sample of light bulbs.
  - Set up a 95% confidence interval estimate of the true average life of light bulbs in this shipment.
  - Set up a 99% confidence interval estimate.
  - Do you think that the manufacturer has the right to state that the light bulbs last an average of 400 hours? Explain.
  - Explain why an observed value of 320 hours or less is not unusual, even though it is outside the confidence interval that you calculated. Support your explanation with a calculation involving the normal distribution.<sup>1</sup>
- (2) The personnel department of a large corporation wants to estimate the family dental expenses of its employees to determine the feasibility of providing a dental insurance plan. A random sample of 50 employees reveals the following family dental expenses (in dollars) for the preceding year.

Family Dental Expenses									
34	8	542	480	365	370	265	558	302	126
153	85	307	166	249	272	269	138	69	526
86	20	415	144	404	190	164	246	312	178
419	303	513	328	327	342	226	222	367	176
4	138	254	29	317	331	333	363	310	342

- Determine the average family dental expenses for your sample.
- Calculate the sample standard deviation of family dental expenses.
- Set up a 90% confidence interval estimate of the average family dental expenses for all employees of this corporation.
- Set up a 98% confidence interval estimate.
- How would the last estimate change if you used **t-values** in place of the standard normal **z-values**?

<sup>1</sup>What is the probability that  $X < 320$ ? Is it less than  $\frac{1}{60}$ ?