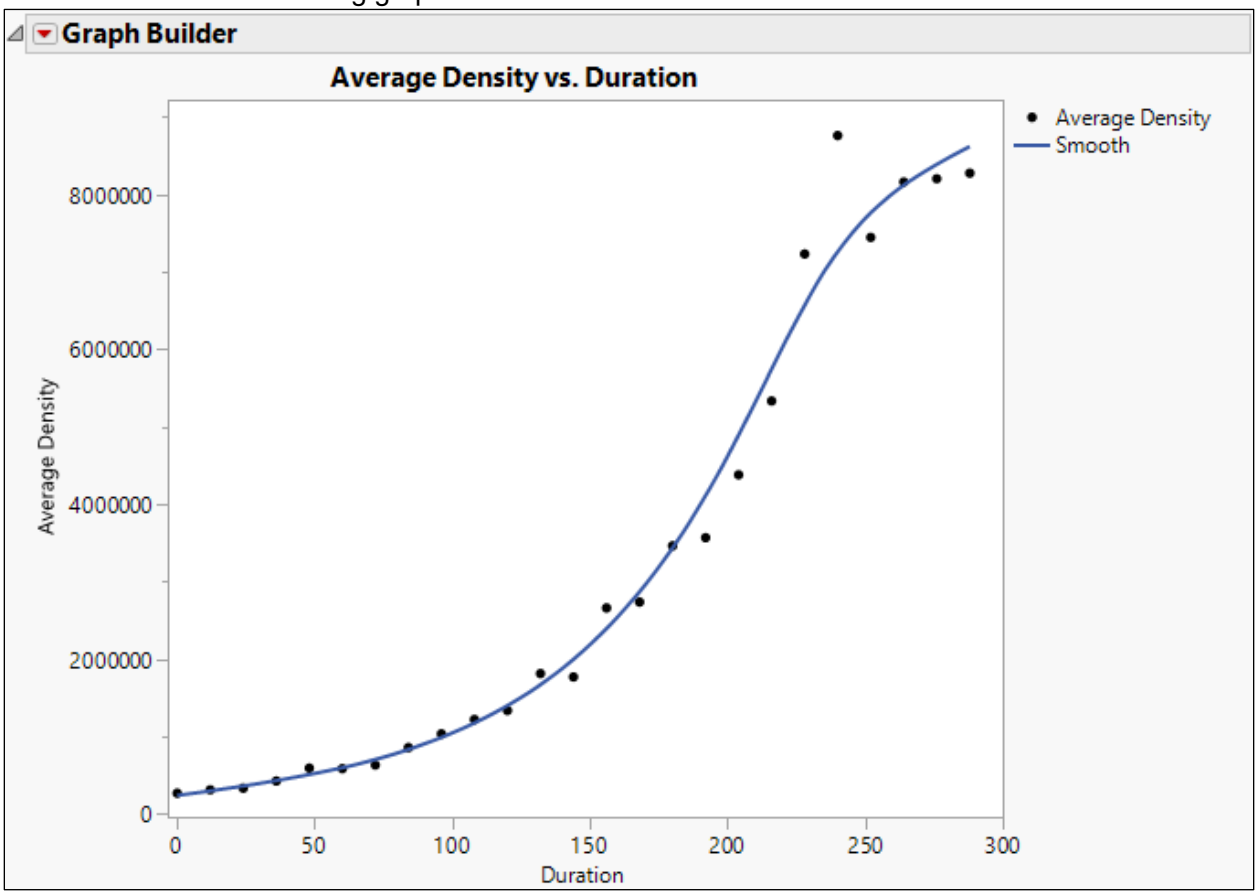
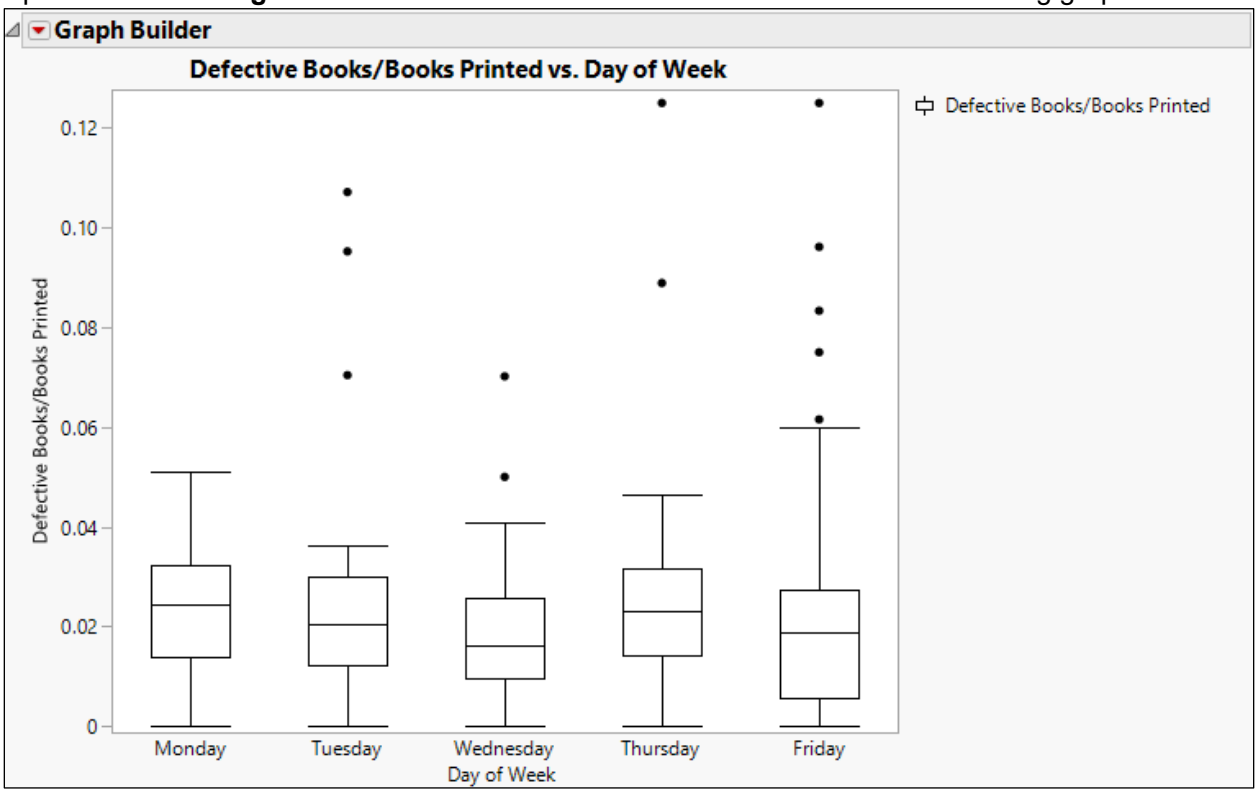
Practices

Extract the data tables from **Formulas Practice.zip** for use in the following Practices.

1. As part of a manufacturing process, cells are grown in bioreactor tanks whose environment is regulated by automated sensors. The cell density is recorded every 12 hours. Three replicated measurements are taken. The growth since the beginning of the run is expected to follow an exponential growth and decay curve. Open the Growth Control data table and add two formula columns to build the following graph.

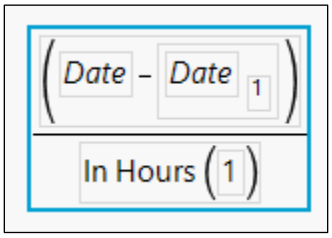


2. A book publisher wishes to know if there are more defective books printed on Monday or Friday. Open the **Publishing** data table and add two formula columns to create the following graph.

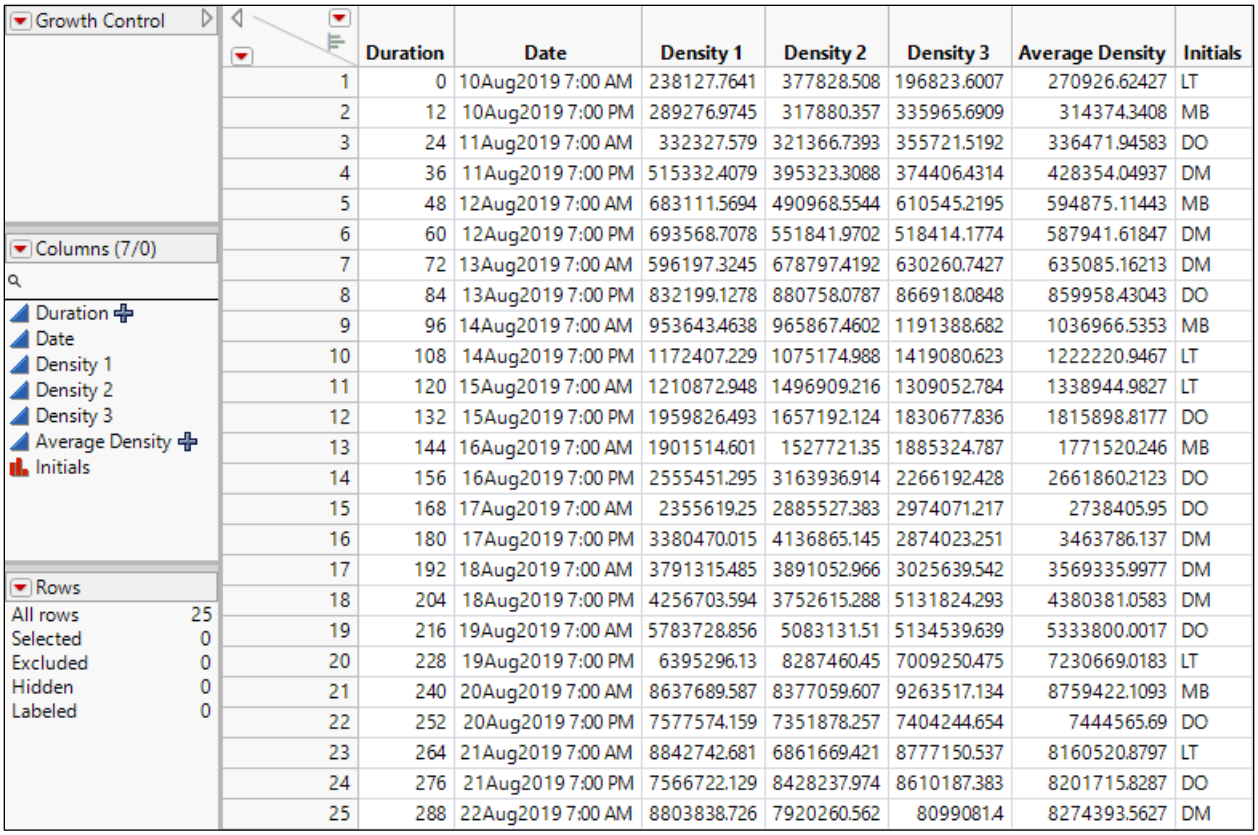


Solutions

1. As part of a manufacturing process, cells are grown in bioreactor tanks whose environment is regulated by automated sensors. The cell density is recorded every 12 hours. Three replicated measurements are taken. The growth since the beginning of the run is expected to follow an exponential growth and decay curve. Open the Growth Control data table and add two formula columns to build the following graph.
   a) Open the **Growth Control** data table.
   b) Right-click the top of the **Date** column and select **Insert Columns**.
   c) Name the new column **Duration**.
   d) Right-click the top of the **Duration** column and select **Formula**.
   e) Click **Date**, then click the subtraction button, then click **Date** again.
   f) With the second **Date** still selected, select **Row** > **Subscript**.
   g) Type 1.
   h) Select the whole formula and click the division button.
   i) Select **Date Time** > **In Hours**.
   j) Type 1.

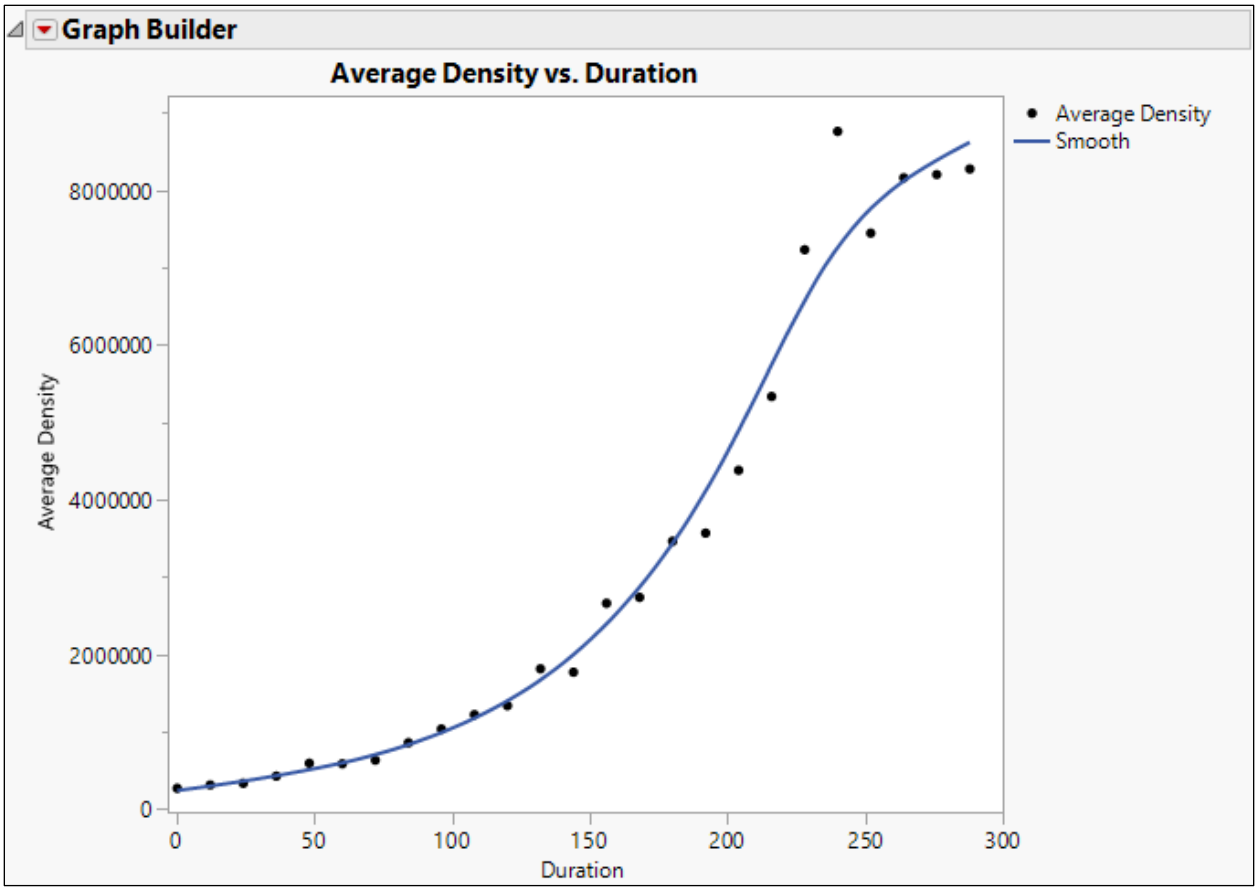


   k) Click **OK**.
   l) Select the three columns **Density 1**, **Density 2**, and **Density 3**.
   m) Right-click at the top of the columns and select **New Formula Column** > **Combine** > **Average**.
   n) Rename this new column to **Average Density**.



	Duration	Date	Density 1	Density 2	Density 3	Average Density	Initials
1	0	10Aug2019 7:00 AM	238127.7641	377828.508	196823.6007	270926.62427	LT
2	12	10Aug2019 7:00 PM	289276.9745	317880.357	335965.6909	314374.3408	MB
3	24	11Aug2019 7:00 AM	332327.579	321366.7393	355721.5192	336471.94583	DO
4	36	11Aug2019 7:00 PM	515332.4079	395323.3088	3744064314	428354.04937	DM
5	48	12Aug2019 7:00 AM	683111.5694	490968.5544	610545.2195	594875.11443	MB
6	60	12Aug2019 7:00 PM	693568.7078	551841.9702	518414.1774	587941.61847	DM
7	72	13Aug2019 7:00 AM	596197.3245	678797.4192	630260.7427	635085.16213	DM
8	84	13Aug2019 7:00 PM	832199.1278	880758.0787	866918.0848	859958.43043	DO
9	96	14Aug2019 7:00 AM	953643.4638	965867.4602	1191388.682	1036966.5353	MB
10	108	14Aug2019 7:00 PM	1172407.229	1075174.988	1419080.623	1222220.9467	LT
11	120	15Aug2019 7:00 AM	1210872.948	1496909.216	1309052.784	1338944.9827	LT
12	132	15Aug2019 7:00 PM	1959826.493	1657192.124	1830677.836	1815898.8177	DO
13	144	16Aug2019 7:00 AM	1901514.601	1527721.35	1885324.787	1771520.246	MB
14	156	16Aug2019 7:00 PM	2555451.295	3163936.914	2266192.428	2661860.2123	DO
15	168	17Aug2019 7:00 AM	2355619.25	2885527.383	2974071.217	2738405.95	DO
16	180	17Aug2019 7:00 PM	3380470.015	4136865.145	2874023.251	3463786.137	DM
17	192	18Aug2019 7:00 AM	3791315.485	3891052.966	3025639.542	3569335.9977	DM
18	204	18Aug2019 7:00 PM	4256703.594	3752615.288	5131824.293	4380381.0583	DM
19	216	19Aug2019 7:00 AM	5783728.856	5083131.51	5134539.639	5333800.0017	DO
20	228	19Aug2019 7:00 PM	6395296.13	8287460.45	7009250.475	7230669.0183	LT
21	240	20Aug2019 7:00 AM	8637689.587	8377059.607	9263517.134	8759422.1093	MB
22	252	20Aug2019 7:00 PM	7577574.159	7351878.257	7404244.654	7444565.69	DO
23	264	21Aug2019 7:00 AM	8842742.681	6861669.421	8777150.537	8160520.8797	LT
24	276	21Aug2019 7:00 PM	7566722.129	8428237.974	8610187.383	8201715.8287	DO
25	288	22Aug2019 7:00 AM	8803838.726	7920260.562	8099081.4	8274393.5627	DM

o) Select **Graph** > **Graph Builder**.
p) Drag **Average Density** to the Y drop zone.
q) Drag **Duration** to the X drop zone.
r) Click **Done**.



s) Close all windows associated with this practice.

2. A book publisher wishes to know if there are more defective books printed on Monday or Friday. Open the **Publishing** data table and add two formula columns to create the following graph.
   a) Open the **Publishing** data table.
   b) Right-click at the top of the **Date** column and select **New Formula Column** > **Date Time** > **Day of Week Name**.
   c) Select both the **Books Printed** and **Defective Books** columns, then right-click at the top of the columns and select **New Formula Column** > **Combine** > **Ratio (reverse order)**.

Publishing

Columns (5/0)

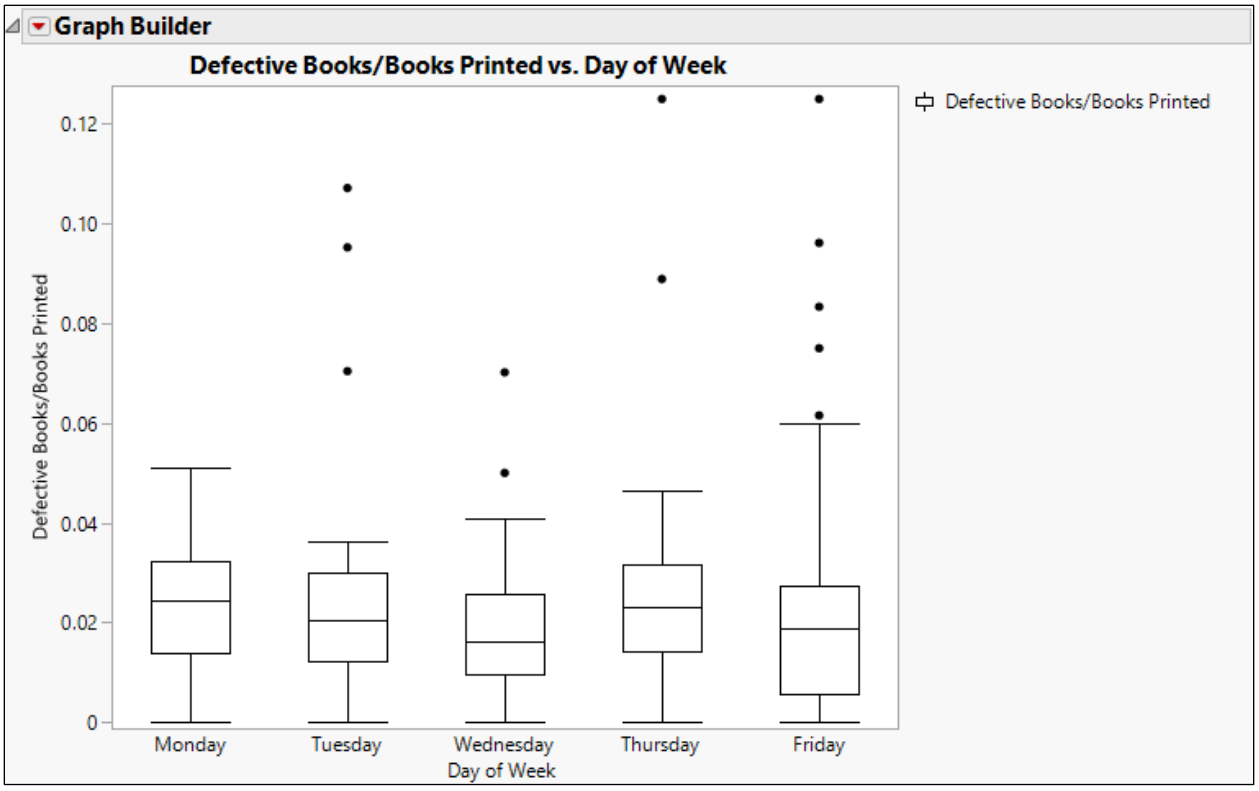
- Date
- Day of Week
- Books Printed
- Defective Books
- Defective Books/Books Printed

Rows

All rows	175
Selected	0
Excluded	0
Hidden	0
Labeled	0

	Date	Day of Week	Books Printed	Defective Books	Defective Books/Books Printed
1	01/04/2021	Monday	121	0	0
2	01/05/2021	Tuesday	143	2	0.013986014
3	01/06/2021	Wednesday	123	3	0.0243902439
4	01/07/2021	Thursday	46	2	0.0434782609
5	01/08/2021	Friday	197	3	0.0152284264
6	01/11/2021	Monday	150	5	0.0333333333
7	01/12/2021	Tuesday	210	3	0.0142857143
8	01/13/2021	Wednesday	159	2	0.0125786164
9	01/14/2021	Thursday	190	7	0.0368421053
10	01/15/2021	Friday	229	1	0.0043668122
11	01/19/2021	Tuesday	192	6	0.03125
12	01/20/2021	Wednesday	75	0	0
13	01/21/2021	Thursday	157	5	0.0318471338
14	01/22/2021	Friday	150	3	0.02
15	01/25/2021	Monday	124	5	0.0403225806
16	01/26/2021	Tuesday	230	3	0.0130434783
17	01/27/2021	Wednesday	54	0	0
18	01/28/2021	Thursday	216	2	0.0092592593

d) Select **Graph** > **Graph Builder**.
e) Drag **Defective Books/Books Printed** to the Y drop zone.
f) Drag **Day of Week** to the X drop zone.
g) Select the Box Plot element.
h) Click **Done**.



No patterns across days are evident.

i) Close all windows associated with this practice.