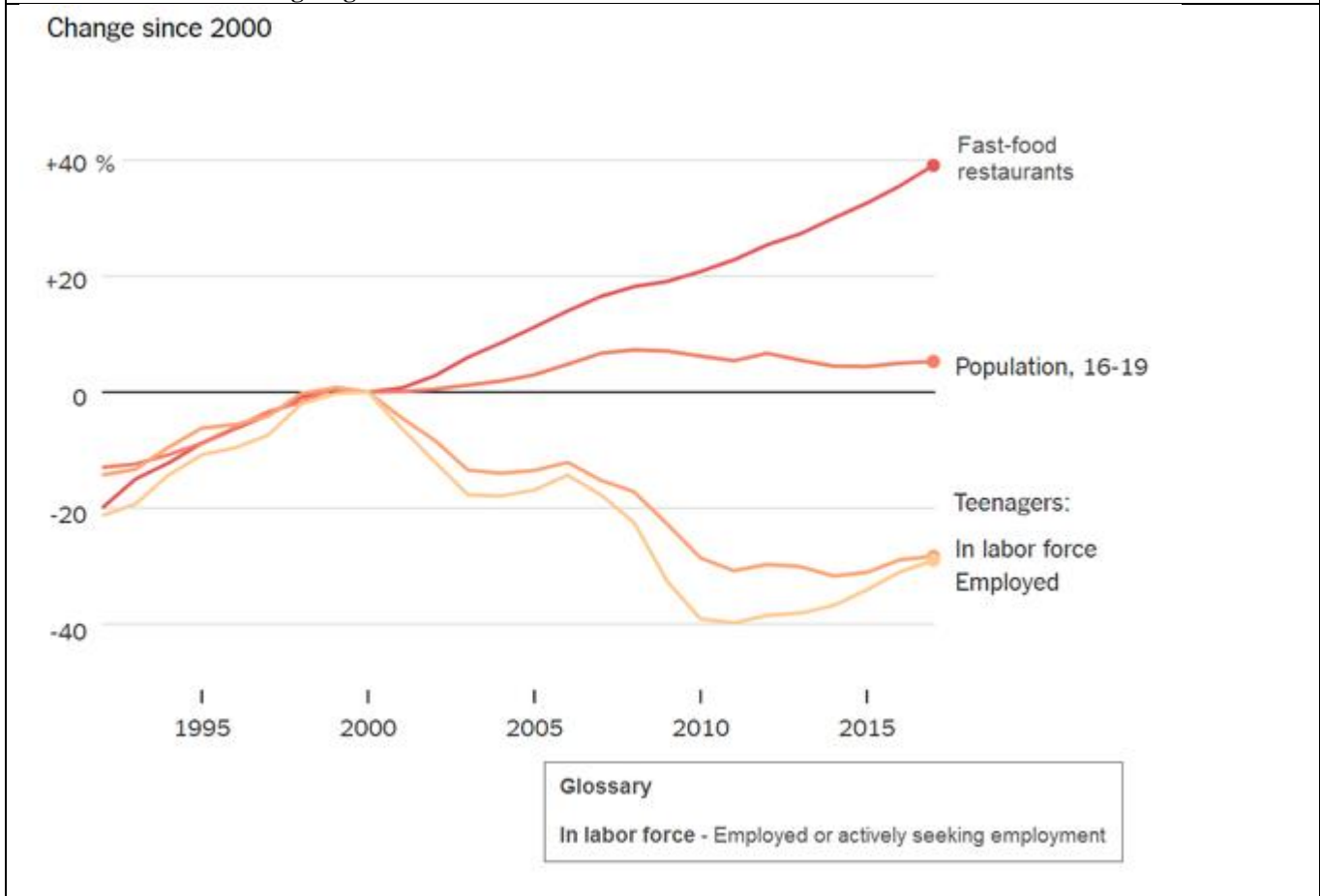# Set 0. Visualizing Data

Skill 0.1: Investigate the ways we can visualize data
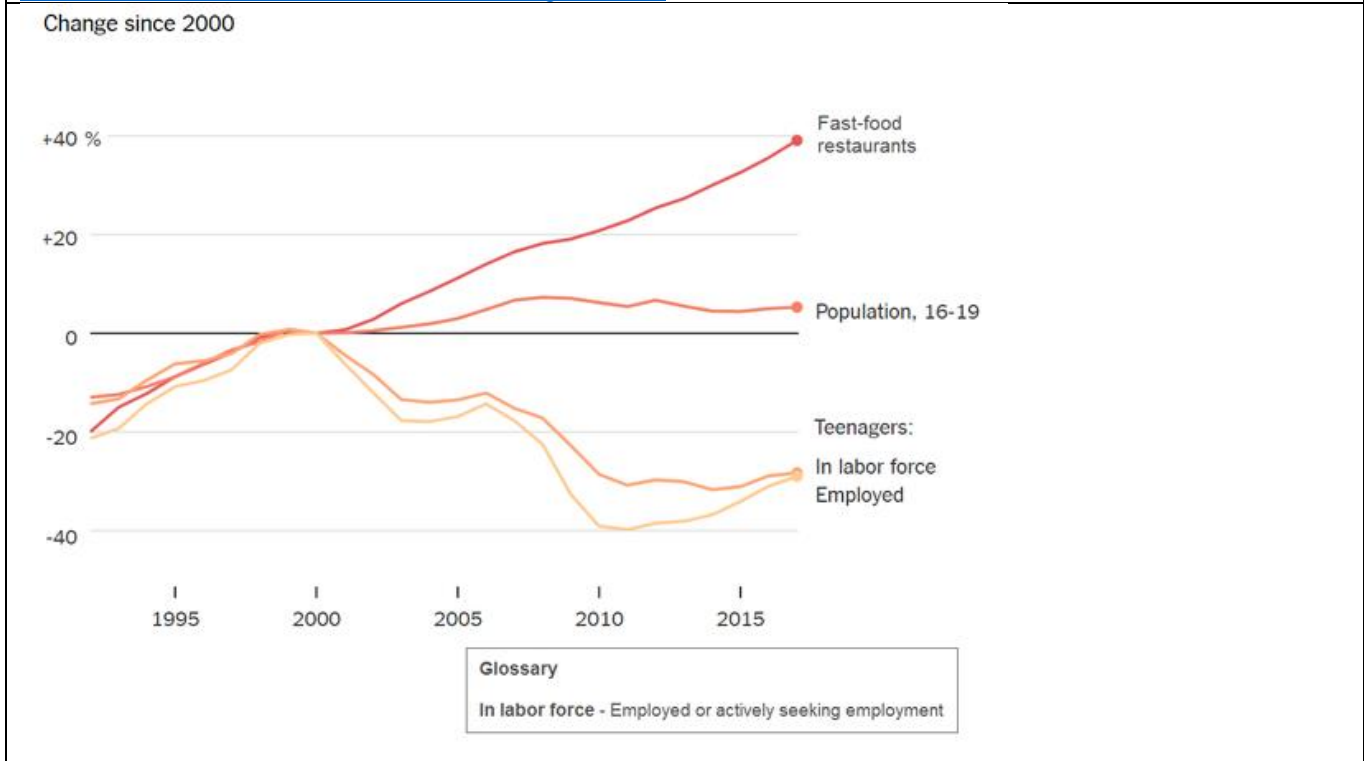
Skill 0.1 Concepts

Skill 0.1 Exercise 1

Today we are going to get practice in telling a data story based on a data visualization. Let's start by looking at a few examples of a data visualization.

Where have all the teenagers gone?
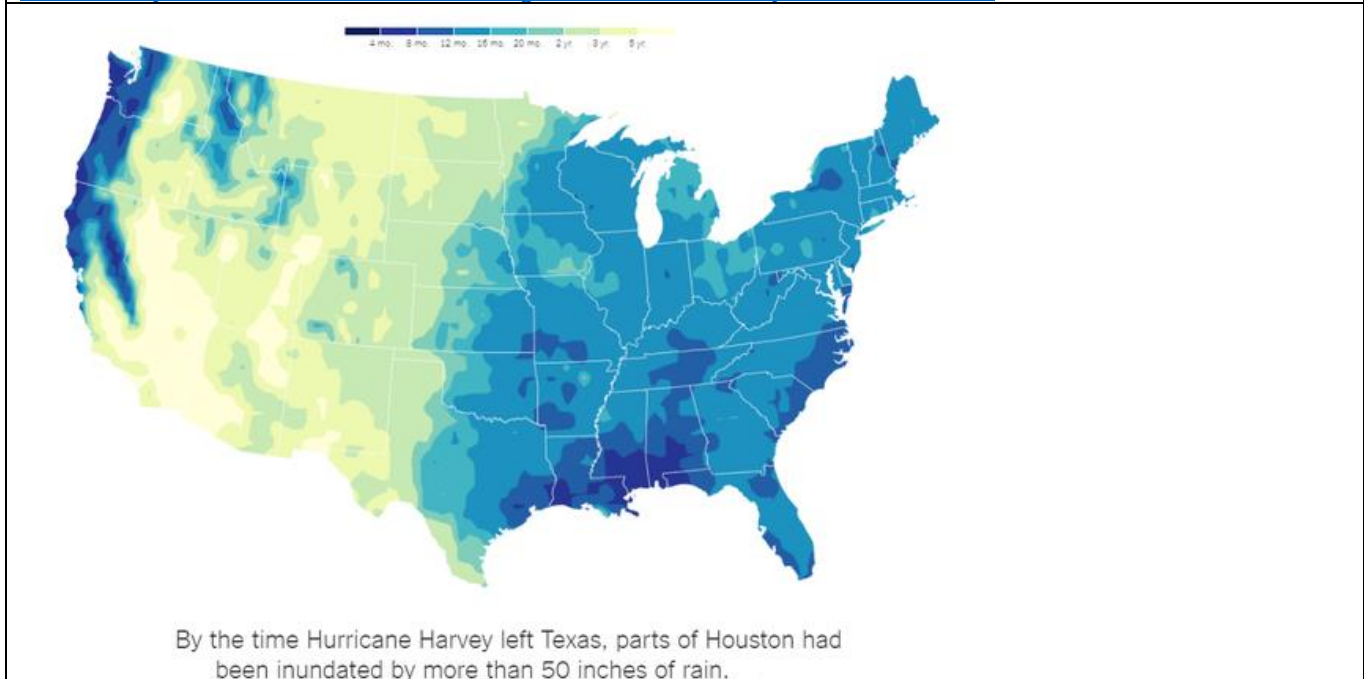
Change since 2000

+40 %

+20

0

-20

-40

1995   2000   2005   2010   2015

Fast-food restaurants

Population, 16-19

Teenagers:

In labor force
Employed

Glossary

In labor force - Employed or actively seeking employment

Change since 2000

+40 %

Fast-food restaurants

+20

0

Population, 16-19

-20

Teenagers:

In labor force
Employed

-40

1995   2000   2005   2010   2015

Glossary

In labor force - Employed or actively seeking employment

4 mo. 8 mo. 12 mo. 16 mo. 20 mo. 2 yr. 3 yr. 5 yr.

By the time Hurricane Harvey left Texas, parts of Houston had been inundated by more than 50 inches of rain.

Skill 0.1 Exercise 2

Skill 0.2 Concepts

The charts above give us information: a collection of facts and patterns extracted from data. We can use this information to identify trends, make connections and address problems.

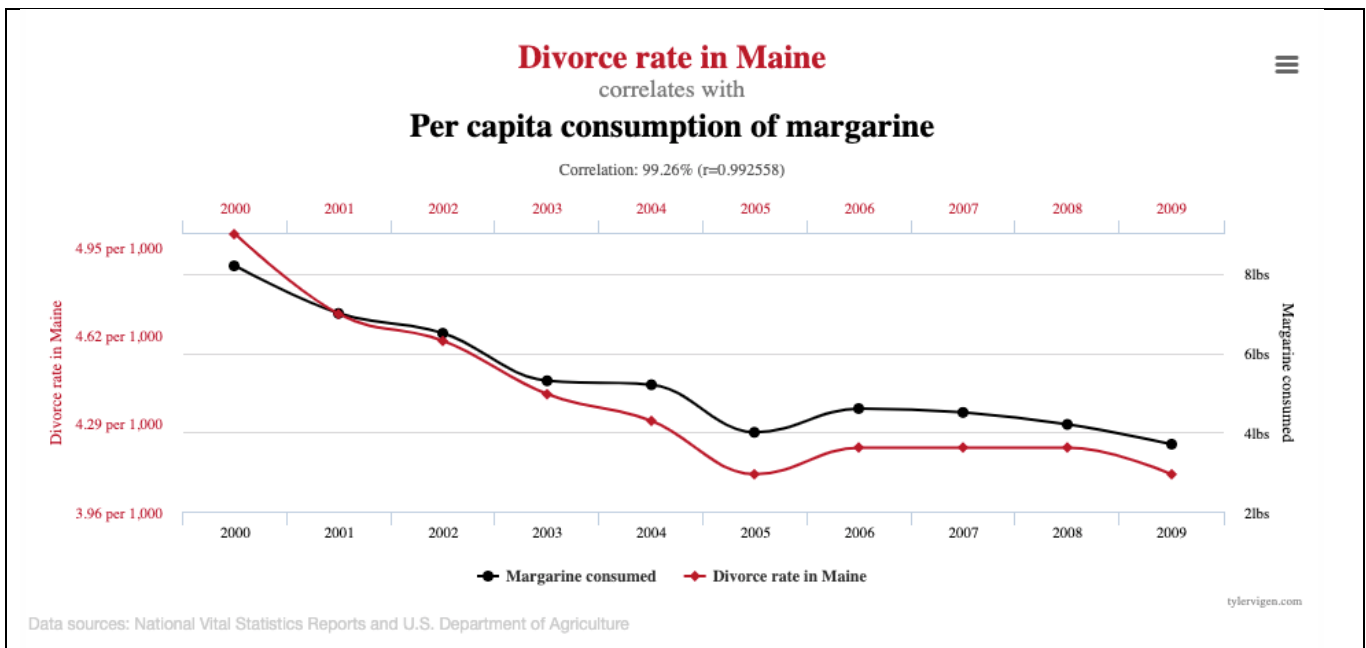There are two distinctions we need to make when looking at a chart or visualization,
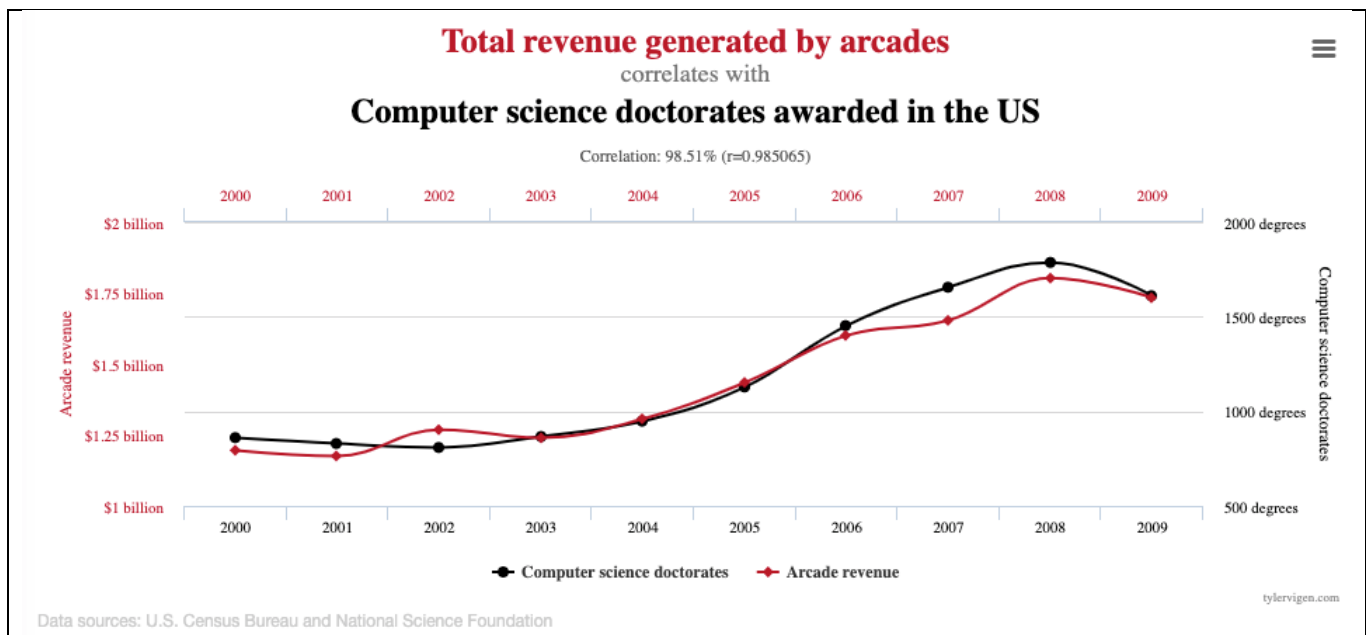
- What does the data show?
- Why might that be the case?

The *"what"* is the facts of the matter. For example, the percentage of teenagers in the workforce has decreased since 2000. The *"why"* is an informed opinion. Fewer teenagers are working <u>because</u> more are focused on their education and earning scholarships.

As you were determining the *"why"*, you may have been tempted to draw concrete connections. However, it's important to remember that correlation (similarities, patterns) does not equal causation (this thing caused that thing). There can be any number of reasons why a pattern or interesting data point may appear in a chart - and our job is to make an informed decision while recognizing that there may be multiple factors at play. Usually, additional research with several data sets is necessary to understand the exact nature of the relationship between data. Did this one thing cause another thing to happen? Do more people search for chocolate because they want to give it as a gift, or could there perhaps be another reason?

<p style="text-align:center">**Correlation** <u>does not equal</u> **Causation**</p>

Check out the following examples,

© Pluska

Total revenue generated by arcades
correlates with
Computer science doctorates awarded in the US

Correlation: 98.51% (r=0.985065)

Data sources: U.S. Census Bureau and National Science Foundation

tylervigen.com

Skill 0.2 Exercises 1 thru 4

Skill 0.3: Identify metadata

Skill 0.3 Concepts

When we consider datasets, it's helpful to know as much about those datasets as possible. Where did the data come from? How much data is included? When was it collected?

All of this information is considered **metadata** which is defined as "data about data".

Meta data differs from the primary data in several ways,

- It can be changed without impacting the primary data
- Used for finding, organizing, and managing information
- Increases effective use of data by providing extra information

Consider the metadata for the image shown below,

file_name	download.jpg
file_size	6.1 kB
file_type	JPEG
file_type_extension	jpg
mime_type	image/jpeg
jfif_version	1.01
resolution_unit	None
x_resolution	1
y_resolution	1
image_width	225
image_height	225
encoding_process	Baseline DCT, Huffman coding
bits_per_sample	8
color_components	3
y_cb_cr_sub_sampling	YCbCr4:2:0 (2 2)
image_size	225x225
megapixels	0.051
category	image
raw_header	FF D8 FF E0 00 10 4A 46 49 46 00 01 01 01 00 00 01 00 01 00 00 FF DB 00 84 00 0A 07 08 15 16 15 18 16 16 18 19 18 18 1A 1C 1C 1C 1A 1A 1C 1E 1C 18 1A 1A 1C 1C 1E 1C 1C 1C 1E 1D 21 2E 27 1C 1E 2B 1F 1C 1A 26 38 26 2B 2F 31 35 35 35 1C 24 3B 40 3B 34 3F 2E 34 35 31 01 0C 0C 0C 10 0F 10 1E 12 12 1A 34 21 24 2B 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34 34

Or, the metadata for a simple email,

```
Delivered-To: heidi.pluska@boiseschools.org
Received: by 2002:a05:6a10:c849:b0:4e4:a636:7fe3 with SMTP id v9csp91318pxy;
        Wed, 9 Aug 2023 17:18:09 -0700 (PDT)
X-Received: by 2002:a05:6a21:9994:b0:12e:7ff9:b612 with SMTP id ve20-
20020a056a21999400b0012e7ff9b612mr1074235pzb.45.1691626689157;
        Wed, 09 Aug 2023 17:18:09 -0700 (PDT)
ARC-Seal: i=3; a=rsa-sha256; t=1691626689; cv=pass;
        d=google.com; s=arc-20160816;
        b=djhjJ1F1iwwOKpRDRBjXodrewTO9u+Eef1lztwWbjakUGcDxF6Tv87FomgCUAeCmiU
         npXUPMiwLY0JDnmWHSCyU6vO+1+z4cNVtAHlRsS8DYE3WFe5A7Rhatr6QVQJ3BFdf/Za
```

```
            vezdBG3Yoj2MrGgo+Y2jGMA1NcfNomo7DeklxUYW0lxhKDlOmfbmzGQPJAviVEbIbSvA
            bVNQk1MuOjuS9v0eIJhesHFCJVK7mJsdkBDMgRadp/cbj36oyRIzeRqsc2/PtwhJgxY+
            rjSLwawzHpGInP2rmcFMzB2Yr1KMygfhKAjCAHJCOgt0b4d4vqpf9xDZHz8CzBzLTW31
            qD/Q==
```
ARC-Message-Signature: i=3; a=rsa-sha256; c=relaxed/relaxed; d=google.com;
s=arc-20160816;
```
        h=list-unsubscribe:list-archive:list-help:list-post:list-id
         :mailing-list:precedence:reply-to:to:subject:message-id:date:from
         :mime-version:dkim-signature;
        bh=BTW9gcu4Q0IEMkwJ2g4l4725cX+f4xU3qfF+gpNKA+A=;
        fh=c06MAeFQ150f7/62zwUC/qQ7khF5udKKgZaxHfAPtuQ=;
        b=HrcLzo0LCdCOpwpGL5a0HFH1+yLlIZPiImENwIyI+df7wNEzvLSAIP1dJB8OGWfqWh
         P15D/NQFmnaATZBH9hk0ywnxHjK7wMb5zosTPqrOTw7v44nNq8PHu16ejMrmCt0NNtrO
         CfniwSPZP9qw9hzkUIkMAoL4q43yvAz0G1YDHppZDyWbq3z8bd8PRQ6SOVEsPrdLlF0Y
         75MRqOqFicPZsDwUlUsaNW63HcTqPlnULhVzGUDDX5TFVDnH5P7H0dXq2VkfNyT/1+mH
         GTZk34fVHTBFP5FMRghnW7WuirJzL4cBjdQzMbbos+yH+J1vkBQGQRo9ZX7A6zb3fygL
         aIwQ==
```
ARC-Authentication-Results: i=3; mx.google.com;
       dkim=pass header.i=@boiseschools.org header.s=google header.b=e2YS5TAj;
       arc=pass (i=2 spf=pass spfdomain=boiseschools.org dkim=pass
dkdomain=boiseschools.org dmarc=pass fromdomain=boiseschools.org);
       spf=pass (google.com: domain of
timberline+bncbcq5rigc6yjrbk6z2ctamgqenxpvlvy@boiseschools.org designates
209.85.220.69 as permitted sender)
smtp.mailfrom=timberline+bncBCQ5RIGC6YJRBK6Z2CTAMGQENXPVLVY@boiseschools.org;
       dmarc=pass (p=NONE sp=NONE dis=NONE) header.from=boiseschools.org
Return-Path: <timberline+bncBCQ5RIGC6YJRBK6Z2CTAMGQENXPVLVY@boiseschools.org>
Received: from mail-sor-f69.google.com (mail-sor-f69.google.com.
[209.85.220.69])
       by mx.google.com with SMTPS id n17-
20020a638f11000000b005488a5e1b72sor249685pgd.2.2023.08.09.17.18.09
       for <heidi.pluska@boiseschools.org>
       (Google Transport Security);
       Wed, 09 Aug 2023 17:18:09 -0700 (PDT)
Received-SPF: pass (google.com: domain of
timberline+bncbcq5rigc6yjrbk6z2ctamgqenxpvlvy@boiseschools.org designates
209.85.220.69 as permitted sender) client-ip=209.85.220.69;
Authentication-Results: mx.google.com;
       dkim=pass header.i=@boiseschools.org header.s=google header.b=e2YS5TAj;
       arc=pass (i=2 spf=pass spfdomain=boiseschools.org dkim=pass
dkdomain=boiseschools.org dmarc=pass fromdomain=boiseschools.org);
       spf=pass (google.com: domain of
timberline+bncbcq5rigc6yjrbk6z2ctamgqenxpvlvy@boiseschools.org designates
209.85.220.69 as permitted sender)
smtp.mailfrom=timberline+bncBCQ5RIGC6YJRBK6Z2CTAMGQENXPVLVY@boiseschools.org;
       dmarc=pass (p=NONE sp=NONE dis=NONE) header.from=boiseschools.org
ARC-Seal: i=2; a=rsa-sha256; t=1691626689; cv=pass;
       d=google.com; s=arc-20160816;
```
        b=c4nMjpNyG5aFXKv6TepVkKwaoJ6s5bdYLLb/S8S132pTFHri+Kxy9WfCTqC3oVfEZR
         AJCLTipLdcPICi4Cc+WlX4slyawLBogRJ2KjSKCRmpF+FgXjoKp0gv70xw6iH3/w8nfp
         U02CqW2HP38qlBfXxUWTMjM/H/JJ+HLbopAmj7HIVKqU0Nh7JOYfxGHQuyfNbpubcLVu
         kYJ1uKlR8t+ZZ0qFi1bqhSpwAD9iM77jm/x2HDRZ9zRcdGcq2450iXzqMTrrGJ5XcQvE
```

```
                dOrjmAY0/yQhTHUnrq/e5tDb0+OpS2X3Uj6CmiXQ02O6TWCPaQSSPaLoqIc2LCWdnpkr
            1ysA==
ARC-Message-Signature: i=2; a=rsa-sha256; c=relaxed/relaxed; d=google.com;
s=arc-20160816;
        h=list-unsubscribe:list-archive:list-help:list-post:list-id
         :mailing-list:precedence:reply-to:to:subject:message-id:date:from
         :mime-version:dkim-signature;
        bh=BTW9gcu4Q0IEMkwJ2g4l4725cX+f4xU3qfF+gpNKA+A=;
        fh=c06MAeFQ150f7/62zwUC/qQ7khF5udKKgZaxHfAPtuQ=;
        b=hx6E7LYCKK+/y+/+CwIBe9OwJUhv+jyO1+DcCt0SePRUqyANX6AuVFar5ebmfkYnXF
         EyAvKJ1bzBRLcQoSrtEvvkQru4wZ7P/M8CJ1NR3BfHxroiQteJleehpspwUJCHEzVicr
         DBogxqWUNcDjk0+fKrMtM84lbJSUSrzmMcfscr5LOO6qKCneQQF7EhbNp+gbtENjrKfw
         ozpZfLbMcj5ukS7+FyutxyossaklN7yRSU/f8ZlFx2K+pKoeazDt8zpP7EJjhMcAphVJ
         nAwfDub9GNq0nnylKK41F3wJbx4Tridih9eOQhY4rK0Yi50q88vWmtnSG1K6babD3ueS
         KYdw==
ARC-Authentication-Results: i=2; mx.google.com;
       dkim=pass header.i=@boiseschools.org header.s=google header.b=Z06r+A7r;
       spf=pass (google.com: domain of michaela.aird@boiseschools.org
designates 209.85.220.41 as permitted sender)
smtp.mailfrom=michaela.aird@boiseschools.org;
       dmarc=pass (p=NONE sp=NONE dis=NONE) header.from=boiseschools.org
DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
        d=boiseschools.org; s=google; t=1691626689; x=1692231489;
        h=list-unsubscribe:list-archive:list-help:list-post:list-id
         :mailing-list:precedence:reply-to:x-original-authentication-results
         :x-original-sender:to:subject:message-id:date:from:mime-version:from
         :to:cc:subject:date:message-id:reply-to;
        bh=BTW9gcu4Q0IEMkwJ2g4l4725cX+f4xU3qfF+gpNKA+A=;
        b=e2YS5TAjwkUY4nyoBxVOne5I/8eEisWgaW0t0yTBLVYYmwvbgMaMoX1TjlUZgvK+/J
         zQIUAzz4cd1ka31cEtrUgiqBXVM5VIjilmxVa9Q0cia7AQM6FbTmHz7Z3B4wqqc7q2wj
         R+kgRLK6Jgw1yXh3N+OjzP7vzNwk3YpHTOFMAgGoQCCfaVb5PAXpgyyC3SZ9QxMFwptY
         rxe68IetoxyNoAnwyHIPP7653dRXBT8HqwwEeFiFfyi9Yn2Enu8R5t1jVawdNltlkv5d
         QvGvw8baVoRKnjZa5KKu7w9vXyMjM5MRtw1sf2NRLMJmbqjZquQ9iUmB1iGMc92fgECR
         xrnw==
X-Google-DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
        d=1e100.net; s=20221208; t=1691626689; x=1692231489;
        h=list-unsubscribe:list-archive:list-help:list-post
         :x-spam-checked-in-group:list-id:mailing-list:precedence:reply-to
         :x-original-authentication-results:x-original-sender:to:subject
         :message-id:date:from:mime-version:x-beenthere:x-gm-message-state
         :from:to:cc:subject:date:message-id:reply-to;
        bh=BTW9gcu4Q0IEMkwJ2g4l4725cX+f4xU3qfF+gpNKA+A=;
        b=RbdcZTtGyksdBRgHxoFgS4UTRU+wE7DUhf756lRbzJ8nezMp3HklMAh/0ayvdeKmQQ
         OFxJfPCHoiSDrCINMYECEDCOTv364UpYe3accN7lkpjRfP0k8SbqznsR1i2kQc+odCRG
         lx2Yq1m1BYyZ7BNopuxoMPPdW1VD3pbysKuFR84+KJtx8+hOsh1VixP1eGqV7S2HoDwd
         ki+7gUiR+Y30GOY6SHgH2bRkSifbUiWYjpqSTMmu0pN/Cyb2OKzq/cQLUuETPZ0jN4xK
         eSAoFceSjhhN1zSvAJ+I3tMMJMWmMevc3JoWdwaT5VxgEdjbvR7s0gfTnLFnJbFQA2eP
         Z52g==
X-Gm-Message-State: AOJu0Yxc9x36bCFG6B6IF8IyFMvrsoP4wOGJTLIT0TUBT2W3y3Pa6OcK
gM4Ie99BZaPJvLYlmVEU6L4ycBNN
X-Google-Smtp-Source:
AGHT+IEiJUceRZGv4uFgQPK7X9TdMp3TvRT7q74hn+BZXy6GtUQFfByOyD6O/uE/PunXRJIspzo2yg=
```

```
=
X-Received: by 2002:a0c:e0d2:0:b0:63d:ffe:2cd2 with SMTP id x18-
20020a0ce0d2000000b0063d0ffe2cd2mr683232qvk.44.1691626667888;
        Wed, 09 Aug 2023 17:17:47 -0700 (PDT)
X-BeenThere: timberline@boiseschools.org
Received: by 2002:a0c:e204:0:b0:635:e560:ecc9 with SMTP id q4-
20020a0ce204000000b00635e560ecc9ls140214qvl.2.-pod-prod-08-us; Wed, 09 Aug 2023
17:17:47 -0700 (PDT)
X-Received: by 2002:a67:f607:0:b0:443:5927:d415 with SMTP id k7-
20020a67f607000000b004435927d415mr406122vso.10.1691626666640;
        Wed, 09 Aug 2023 17:17:46 -0700 (PDT)
ARC-Seal: i=1; a=rsa-sha256; t=1691626666; cv=none;
        d=google.com; s=arc-20160816;
        b=kHqHU19bdfe7TF9u6aJ0uDizKtbpsQaMXlDuqDlYd+xL+beShndw9/HY/GeVbwPU1r
         xwYC/LhSfvCHGs4ayi5BR6GEL3UQGeQrIAzsNBcd8YnZKLPqeU5QHQ1rrKwJMvMVOs7a
         0JTj2n5pUMnV5PerwEqV8k2KllhzyoWmZvxf8ao9efGxAeqa3c0KtVvUUWfdG2//gkh/
         PDm9SZ+csZKvKpRYHm5yuuEfXK895GmkZj0T1Z5Z02xuPtUUxLOXhTkB9Pk+nUXLCin5
         YOXINTDIvMQ4OtM3cv0C8VAE+3RL0Qbg0eyrrR4iuj3zrR73WkGyrFaG/ZExXRlVkjiA
         L3Xg==
ARC-Message-Signature: i=1; a=rsa-sha256; c=relaxed/relaxed; d=google.com;
s=arc-20160816;
        h=to:subject:message-id:date:from:mime-version:dkim-signature;
        bh=BTW9gcu4Q0IEMkwJ2g4l4725cX+f4xU3qfF+gpNKA+A=;
        fh=c06MAeFQ150f7/62zwUC/qQ7khF5udKKgZaxHfAPtuQ=;
        b=NWmH0Tfgj7u0KiOE8haFWQyrEnREQvFpbbHqaPdJI/Ta1JRbvMMHM4f4kGTVsJoO1d
         SxabItBlIGWv9izO1WXXZjifupVhu7BJDo848M0gzuXLvj4Ovs1mXP/DZpPx8Gc972Bo
         958BswZBsv/pzD0uiPJhgtlm/IE2uYam0CmBKdAzIMxioLZy+9bHaXdNizxweTJrg/x5
         aW9uahXdgCERjuAQsi3Pc7bW9fxKabQ5p/UMKklC8G4a0whhvJVM+IDrAfFdeGCuMueY
         X9YeLxLxWsGH6VIWjHMDG5mKh7yuo6XyABaiSXZTzigIHMNc7ngtY3IBHi7/8iRNKNaX
         PH1g==
ARC-Authentication-Results: i=1; mx.google.com;
       dkim=pass header.i=@boiseschools.org header.s=google header.b=Z06r+A7r;
       spf=pass (google.com: domain of michaela.aird@boiseschools.org
designates 209.85.220.41 as permitted sender)
smtp.mailfrom=michaela.aird@boiseschools.org;
       dmarc=pass (p=NONE sp=NONE dis=NONE) header.from=boiseschools.org
Received: from mail-sor-f41.google.com (mail-sor-f41.google.com.
[209.85.220.41])
        by mx.google.com with SMTPS id u24-
20020a67d998000000b00440964f00e7sor53827vsj.15.2023.08.09.17.17.46
        for <timberline@boiseschools.org>
        (Google Transport Security);
        Wed, 09 Aug 2023 17:17:46 -0700 (PDT)
Received-SPF: pass (google.com: domain of michaela.aird@boiseschools.org
designates 209.85.220.41 as permitted sender) client-ip=209.85.220.41;
X-Received: by 2002:a05:6102:3a79:b0:447:48ab:cff2 with SMTP id bf25-
20020a0561023a7900b0044748abcff2mr394218vsb.19.1691626666079; Wed, 09 Aug 2023
17:17:46 -0700 (PDT)
MIME-Version: 1.0
From: Michaela Aird <michaela.aird@boiseschools.org>
Date: Wed, 9 Aug 2023 18:17:10 -0600
Message-ID: <CAENF_e89mXDzT-iWQWhScRkPKvBBU1p_AWOpw1KS3T2MR-
```

```
0PbA@mail.gmail.com>
Subject: laptop wireless connection issue
To: Timberline <timberline@boiseschools.org>
Content-Type: multipart/alternative; boundary="000000000000864b420602868612"
X-Original-Sender: michaela.aird@boiseschools.org
X-Original-Authentication-Results: mx.google.com;
       dkim=pass header.i=@boiseschools.org header.s=google header.b=Z06r+A7r;
       spf=pass (google.com: domain of michaela.aird@boiseschools.org
designates 209.85.220.41 as permitted sender)
smtp.mailfrom=michaela.aird@boiseschools.org;
       dmarc=pass (p=NONE sp=NONE dis=NONE) header.from=boiseschools.org
Reply-To: michaela.aird@boiseschools.org
Precedence: list
Mailing-list: list timberline@boiseschools.org; contact
timberline+owners@boiseschools.org
List-ID: <timberline.boiseschools.org>
X-Spam-Checked-In-Group: timberline@boiseschools.org
X-Google-Group-Id: 356933416772
List-Post:
<https://groups.google.com/a/boiseschools.org/group/timberline/post>,
<mailto:timberline@boiseschools.org>
List-Help:
<https://support.google.com/a/boiseschools.org/bin/topic.py?topic=25838>,
<mailto:timberline+help@boiseschools.org>
List-Archive: <https://groups.google.com/a/boiseschools.org/group/timberline/>
List-Unsubscribe: <mailto:googlegroups-
manage+356933416772+unsubscribe@googlegroups.com>,
<https://groups.google.com/a/boiseschools.org/group/timberline/subscribe>


--000000000000864b420602868612
Content-Type: text/plain; charset="UTF-8"


If you are experiencing issues with your Windows laptop connecting to
wireless please follow these steps:

1. connect to wi-fi network *BSD-Devices* with password *Boise2023 *
OR plug in to the wall with an ethernet cable, restart, and log in.
(tech leads can help with this!)

2. contact the Help Desk <https://support.boiseschools.org/> so that they
can follow up and get the device properly managed. Without IT servicing,
the device will continue to have issues.
--

Michaela Aird

Spanish 3 & 4
AP Capstone Research
Timberline High School
World Languages Department Head
Building Tech Lead
```

```
--000000000000864b420602868612
Content-Type: text/html; charset="UTF-8"
Content-Transfer-Encoding: quoted-printable

<div dir=3D"ltr"><div class=3D"gmail_default" style=3D""><font face=3D"aria=
l, sans-serif">If you are experiencing issues with your Windows laptop conn=
ecting to wireless please follow these steps:</font></div><div class=3D"gma=
il_default" style=3D""><font face=3D"arial, sans-serif"><br></font></div><d=
iv class=3D"gmail_default" style=3D""><font face=3D"arial, sans-serif">1. c=
onnect=C2=A0to wi-fi network=C2=A0<b>BSD-Devices</b>=C2=A0with password=C2=
=A0<b>Boise2023=C2=A0</b></font></div><div class=3D"gmail_default" style=3D=
""><font face=3D"arial, sans-serif">OR<b>=C2=A0</b>plug in to the wall with=
 an ethernet cable, restart, and=C2=A0log in.</font></div><div class=3D"gma=
il_default" style=3D""><font face=3D"arial, sans-serif">(tech leads can hel=
p with this!)</font></div><div class=3D"gmail_default" style=3D""><font fac=
e=3D"arial, sans-serif"><br></font></div><div class=3D"gmail_default" style=
=3D""><font face=3D"arial, sans-serif"><font color=3D"#000000">2.=C2=A0cont=
act the=C2=A0<a href=3D"https://support.boiseschools.org/" target=3D"_blank=
" style=3D"">Help Desk</a>=C2=A0so that they can follow up and get the devi=
ce properly managed. Without IT servicing, the device will continue to have=
 issues.=C2=A0</font><b style=3D"color:rgb(230,145,56)">=C2=A0</b></font></=
div><font face=3D"arial, sans-serif"><span class=3D"gmail_signature_prefix"=
>--</span></font><div><font face=3D"arial, sans-serif"><span class=3D"gmail=
_signature_prefix"></span><br></font><div dir=3D"ltr" class=3D"gmail_signat=
ure" data-smartmail=3D"gmail_signature"><div dir=3D"ltr"><div><div dir=3D"l=
tr"><font face=3D"arial, sans-serif">Michaela Aird</font><div><font face=3D=
"arial, sans-serif"><br></font></div><div><font face=3D"arial, sans-serif">=
Spanish 3 &amp; 4=C2=A0</font></div><div><font face=3D"arial, sans-serif">A=
P Capstone Research=C2=A0</font></div><div><font face=3D"arial, sans-serif"=
>Timberline High School=C2=A0</font></div><div><font face=3D"arial, sans-se=
rif">World Languages Department Head</font></div><div><font face=3D"arial, =
sans-serif">Building Tech Lead</font></div></div></div></div></div></div></=
div>

--000000000000864b420602868612--
```

Skill 0.3 Exercises 1 thru 4