TMC ENGINEERING HIRING EXERCISE

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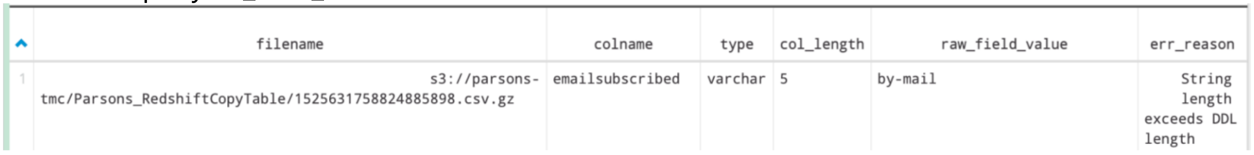
TASK 1

One of our ETL scripts failed while bringing new data into the sample_data.email_activity table in Redshift, producing an error message that references further diagnostic information available from the stl_load_errors system table.
When we query stl_load_errors for more details, this is what we see:



	filename	colname	type	col_length	raw_field_value	err_reason
1	s3://parsons-tmc/Parsons_RedshiftCopyTable/1525631758824885898.csv.gz	emailsubscribed	varchar	5	by-mail	String length exceeds DDL length

What Redshift/SQL query would you run to resolve the issue before re-running the failed portion of the data sync?

The problem is the raw value, 'by-mail' is larger than the column length (5) for the emailsubscribed column it is being loaded into.

The quick solution would be to simply truncate the raw field to a length of 5 so it fits. That is a simple LEFT() command in SQL. However, this still loads ambiguous on unusable data into the result table.

Along with loading the data, we also want to transform the data into meaningful and usable values so analysts do not have to repeatedly perform complicated transforms later. Because we are getting data from multiple sources, not all sources will have the values in the same format or options the analysts need. The ETL process needs to transform the different data sets before loading into the format the analysts need.

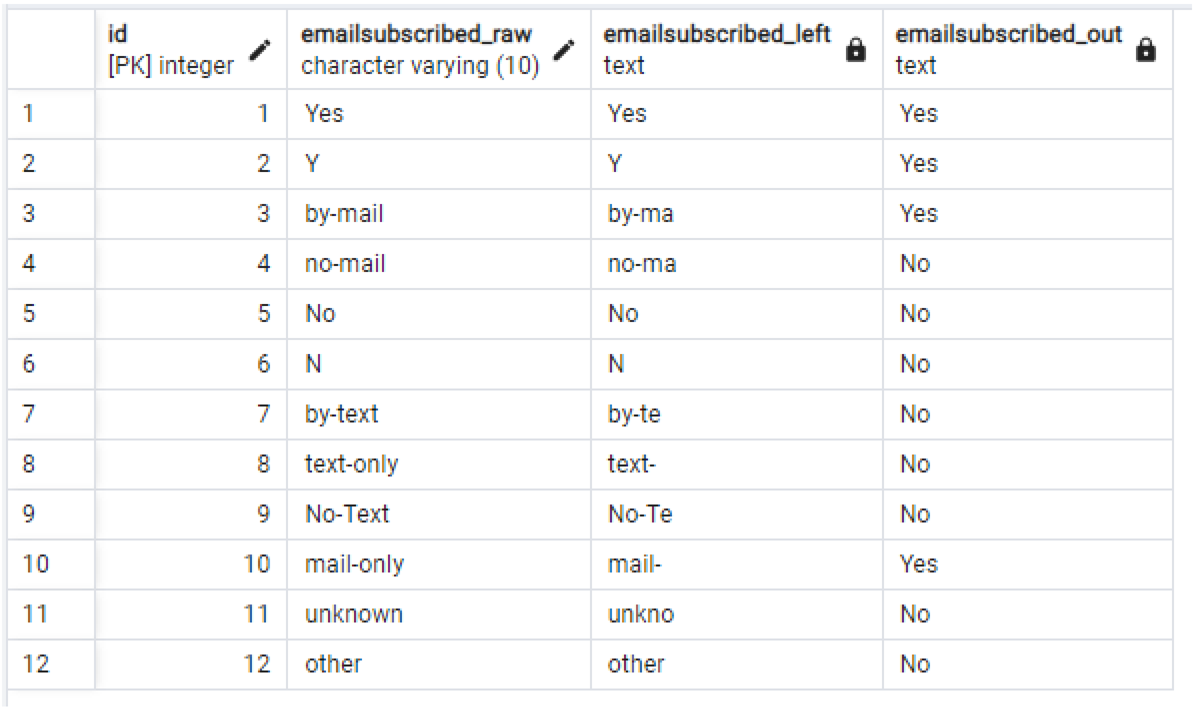
The better solution is to try and determine what end value for email subscribed the raw value is supposed to map to. Assuming the desired values for email subscribed are either Yes or No, then the way to do this in SQL is with a CASE statement that maps the incoming raw values to the allowed result values. In this case, I added a new case statement to map anything containing 'mail' to Yes after the rule that maps anything with 'no' to No. The default in this case is No since we have to assume they have not subscribed if we do not have a positive confirmation.

SQL SCRIPT

```sql
SELECT c.id, c.emailsubscribed_raw
    , LEFT(c.emailsubscribed_raw,5) AS emailsubscribed_left
    , CASE
        WHEN LOWER(c.emailsubscribed_raw) = 'y' THEN 'Yes'
        WHEN LOWER(c.emailsubscribed_raw) LIKE '%yes%' THEN 'Yes'
        WHEN LOWER(c.emailsubscribed_raw) = 'n' THEN 'No'
        WHEN LOWER(c.emailsubscribed_raw) LIKE '%no%' THEN 'No'
        WHEN LOWER(c.emailsubscribed_raw) LIKE '%mail%' THEN 'Yes'
        WHEN LOWER(c.emailsubscribed_raw) LIKE '%text%' THEN 'No'
        ELSE 'No'
    END
    AS emailsubscribed_out
FROM test.contact_types c
```

RESULTS

I created a table with some sample raw values that I would expect for the field. The results below show the difference between the raw value, what a straight left truncation would give, and what the mapping would give for the raw values. The last column is the preferred answer for this question.



	id [PK] integer	emailsubscribed_raw character varying (10)	emailsubscribed_left text	emailsubscribed_out text
1	1	Yes	Yes	Yes
2	2	Y	Y	Yes
3	3	by-mail	by-ma	Yes
4	4	no-mail	no-ma	No
5	5	No	No	No
6	6	N	N	No
7	7	by-text	by-te	No
8	8	text-only	text-	No
9	9	No-Text	No-Te	No
10	10	mail-only	mail-	Yes
11	11	unknown	unkno	No
12	12	other	other	No

TASK 2

Processing text data can be challenging, and our syncs often take steps to normalize data.
What Python code would you run to strip all formatting from a set of U.S. phone numbers and store them as a consistent 10-digit string?

I wrote two python functions, one to normalize the data and one to format the phone number. The format method calls normalize to ensure that the data is normalized before formatting. This way programmers don't have to remember to call normalize first.

NORMALIZE

In the normalize method, I mainly use the isdigit() method to filter out any non-digit characters. The exception is I converted any instances of the character 'O' to a zero, as this often gets typed incorrectly in the data. I tried to use the regex library for parsing out digits faster, but the resulting outcome from regex findall() for values that had invalid characters such as # or '-' was inconsistent so it seemed to take more time to reassemble the regex results into a valid phone number.

I did some data correction based on the size of the phone number coming in. If it was over 10 digits, I assume it was an international number and truncated it to 10 characters starting from the right. This removes leading country codes. If it was a 7-digit number, I added a default local area code. Otherwise if it did not have enough valid digits, I return a blank string.

FORMAT

I provided two possible formats, one with dashes and one with the area code in parenthesis. It will default to the dash format. I use format option codes which would be similar to how operating systems pass a value to indicate the localized phone number format. It would be better to have a method that pulls the format from the code then parse the phone number using sprint rather than breaking out each format as I did. I moved on to the next question instead.

CODE

The python code is attached in the file **TMC_Q2_phones.py**

It uses the input file **TMC_Q2_sample.csv** as sample data and **TMC_Q2_results.csv** as the output

```
import os
import shutil
import csv
import re # regex
from csv import DictReader
from csv import DictWriter

wrksp = r"G:\Safe Documents\Resume\PoliticJobs\DataEngineer\Tests\TMC"
sampleFileIn = os.path.join(wrksp, "TMC_Q2_sample.csv")
sampleFileOut = os.path.join(wrksp, "TMC_Q2_results.csv")

TAB = "\t"
DLM = "|"
EOL = '\n'
NULL = "NULL"
UP_O = 'O'
Lower_O = 'o'
ZERO = '0'

LOCAL_AREA_CODE = '888'
FORMAT_DASH = 1
FORMAT_AREA = 2


def normalizePhone(phoneIn) :
    phoneOut = ""
    try:
        # parse for digits only
        for char in phoneIn :
            if (char.isdigit()) :
                phoneOut += char
            elif (UP_O == char) or (Lower_O == char) :
                # convert letter O to zero
                phoneOut += ZERO
            # end if
        # end for each char

        # 7-digits assumes the area code was left off and will use a default
local area code
        if (len(phoneOut) == 7):
            phoneOut = LOCAL_AREA_CODE + phoneOut
        # truncate to 10 digits
        # assumes international numbers have leading digits to truncate.
        # so it will truncate from the left, pulling the right-most 10 digits
        elif (len(phoneOut) > 10) :
            phoneOut = phoneOut[-10:]
        # check for min and max digits
        # this will blank out the phone number as invalid
        # over 16 assumes an invalid entry as international numbers are less
than this.
        elif (len(phoneOut) < 10) or (len(phoneOut) >= 16) :
            phoneOut = ""
        # end if

    except:
        print("ERROR converting phone value: " + phoneIn)
        phoneOut = ""
    # end try

    return phoneOut

# end normalizePhone

def formatPhone(phone, formatCode) :
    # for user convenience, this will assume the phone needs to be normalized
first
    # this way, it ensures the phone numbers are valid before formatting

    phoneNorm = normalizePhone(phone)
    phoneOut = phoneNorm
    if (len(phoneOut) == 10) : # valid phone has 10 digits

        if (FORMAT_AREA == formatCode) :
            phoneOut = "(" + phoneNorm[:3] + ") " + phoneNorm[3:6] + "-" +
phoneNorm[6:]
        # end if
        else : # use FORMAT_DASH
            phoneOut = phoneNorm[:3] + "-" + phoneNorm[3:6] + "-" +
phoneNorm[6:]
        # end if
    # end if valid phone
    return phoneOut
# end formatPhone



#########################################
# read each sample phone number and format it.
#########################################
with open(sampleFileOut, 'w', newline='') as write_csv:
    # field names
    fields = ['name', 'raw', 'normalized', 'dash-foramt', 'area-foramt']
    # write column headers
    csvwriter = csv.DictWriter(write_csv, fieldnames = fields)
    csvwriter.writeheader()
    rowsOut = []

    with open(sampleFileIn, 'r') as read_obj:
        csv_dict_reader = DictReader(read_obj)
        for row in csv_dict_reader:

            name = row["name"]
            phoneRaw = row["phone"]
            # normalize phone number
            phoneOut = normalizePhone(phoneRaw)
            testOut = "Test: " + name + TAB+ "Raw[" + phoneRaw + "]" + TAB +
"Norm[" + phoneOut + "]"
            testOut += TAB + "Dash[" + formatPhone(phoneRaw, FORMAT_DASH) +
"]"
            testOut += TAB + "Area[" + formatPhone(phoneRaw, FORMAT_AREA) +
"]"
            print(testOut)

            # Write results to csv
            rowOut = {}
            rowOut["name"] = name
            rowOut["raw"] = phoneRaw
            rowOut["normalized"] = phoneOut
            rowOut["dash-foramt"] = formatPhone(phoneRaw, FORMAT_DASH)
            rowOut["area-foramt"] = formatPhone(phoneRaw, FORMAT_AREA)
            rowsOut.append(rowOut)
        # end for each row
    # end with csv read

    #Write as CSV file
    csvwriter.writerows(rowsOut)
    print("WRITE file: " + sampleFileOut)
# end with write csv
del write_csv
del rowsOut
```

TASK 3

One of our syncs is broken, and we need to communicate the outage to TMC's member organizations
in our #bugs-and-outages Slack channel.
Here's what we know:
- A vendor changed how they configure security on their side for a database mirror, and they will now require an SSL certificate
- We run the data sync via a Civis Platform job template, and Civis support staff need to talk to the vendor's Engineering team about how to handle the certificate
- TLDR; we're relying on outside entities to fix things that we don't directly control, so we do not have a clear timeline for resolution

Can you write a member-facing message about this outage?

RESPONSE

#bugs-and-outages

We are experiencing an outage in our data syncs due to a connection problem with one of our vendors. There is no loss of data, but the data will not be updated and synced until the problem is resolved. The process is controlled by our Civis Platform and we are actively working with their support staff to resolve the problem as quickly as possible with the vendor. We do not yet have a timeline for a resolution, but we will keep you posted of any progress.

TASK 4

Build a pair of scripts that will:

1. pull voter file data from the Ohio Secretary of State website, and
2. match a provided input CSV file to that voter data, creating another CSV which looks like the input (including the row column) but has an extra column **matched_voterid** that specifies the matches.
3. include a README explaining your approach.

The input CSV file: https://drive.google.com/open?id=1o3SWFV1oJ4Z3hr6nFPAQPO8y8wWtlfgL
For gathering the voter file: Ohio is one of the few states that makes it really easy for anyone to download the voter file, which is the list of registered voters in the state.

- First check out https://www6.sos.state.oh.us/ords/f?p=111:1 to see where the data comes from, and what is the data format.
- Then you can download each county's data by using URLs like https://www6.sos.state.oh.us/ords/f?p=VOTERFTP:DOWNLOAD::FILE:NO:2:P2_PRODUCT_NUMBER:1, where that last number is a county number from 1 to 88. For performance reasons, you can limit your matching to the first 4 counties' data.

Matching is a "fuzzy" process that often doesn't have a clear right answer, so you'll have to weigh tradeoffs and make decisions, eg. how much to normalize strings, how much to weigh certain columns, what to do when there isn't a clear match, etc. Make decisions that seem reasonable to you, and document any interesting tradeoffs.

Spend no more than a few hours on this test, and feel free to wrap up sooner if you have a solid first pass. You will certainly have further improvements you would make with more time and with more input from users. As part of your README, explain those potential improvements and open questions. Those are as important as the code.

README
TMC_Q4_README.txt

SCRIPT:
TMC_Q4_MatchVoters.py

RESULTS:
TMC_Q4_Results.csv

CODE:
```
import os
import shutil
from datetime import datetime
import csv
from csv import DictReader
from csv import DictWriter
##################################################
```

```python
# TMC Q4:
# Match list of names, birth year, and address to Ohio Voter files
# Steps:
# Read voter info from voter files
# Build a data dictionary lookup based on birtyYear+zip5 as the key
# Read match file info
# lookup maches based on birtyYear+zip5 key
##################################################


dirTMC = r"G:\Safe Documents\Resume\PoliticJobs\DataEngineer\Tests\TMC"
dirVoterFiles = os.path.join(dirTMC, "Ohio_VoterFiles")
fileNameIn = os.path.join(dirTMC, "eng-matching-input-v3.csv")
fileNameOut = os.path.join(dirTMC, "TMC_Q4_Results.csv")
dirOut = dirTMC

wrksp = dirTMC
os.chdir(wrksp)
print(os.getcwd())

if not os.path.exists(dirOut):
    os.makedirs(dirOut)

TAB = "\t"
DLM = "|"
EOL = '\n'
SPACE = ' '

##################################################
# Voter info
# This class holds the voter's info from the voter file
##################################################
class VoterInfoClass:

    def __init__(self) :
        self.voterID = ""
        self.countyID = ""
        self.lastName = ""
        self.firstName = ""
        self.dateOfBirth = ""
        self.birthYear = ""
        self.zip5 = ""
        self.key = ""
    # end init

    def GetData(self, rowOut):
        contacts = self.contactCount()
        rowOut['contactCount'] = contacts
        rowOut['phone'] = self.phone
        rowOut['email'] = self.email
        return rowOut
    # end GetData()

    def GetHeader(self):
        header = ['contactCount', 'phone', 'email']
        return header
    # end GetHeader()
```

```
#end VoterInfoClass

##################################################
# parseLastName
# Parse the last name from the input file which has it as one value
# Examples:
# Jeremy T Patterson -> Patterson
# Juanita J Dettwiller -> Dettwiller
##################################################
def parseLastName(name) :
    # Assumes last name is separated by a blank space from the rest of the
name
    lastName = ""
    ixSpace = name.rfind(SPACE) # finds last instance of SPACE
    if (ixSpace > -1) :
        lastName = name[ixSpace+1:]
    #endif
    return lastName
# end parseLastName

##################################################
# matchLastName
# Check if the last names match
# Do any cleaning on the names here to help ensure they match
# Examples:
# user lower to prevent case mismatch
# Remove any suffix such as JR. SR.
##################################################
def matchLastName(matchLastNameIn, VoterLastNameIn) :
    #
    match = False
    matchLastName =
matchLastNameIn.lower().replace('.',"").replace("jr","").replace("sr","")
    VoterLastName =
VoterLastNameIn.lower().replace('.',"").replace("jr","").replace("sr","")
    if (VoterLastName == matchLastName) :
        match = True
    #endif
    return match
# end parseLastName


##################################################
# data Dictionary
# This is a key-value dictionary
# key = birthYear + zip5
# returns List of VoterInfoClass objects with that key
# Example:
# key[1994+33344] = [Voter1, Voter2, Voter3]
# Voter# = an instance of VoterInfoClass
#
# dictVotersByBirth
# same as above, but the key is just the birth year.
##################################################
dictVotersByBirthZip = {}
dictVotersByBirth = {}
```

```
##################################################
# Get Voter info
# Recurse through voter files.
# This builds the data dictionary used for lookup
##################################################
for countyFile in os.listdir(dirVoterFiles) :
    fnameCounty = os.path.join(dirVoterFiles, countyFile)

    with open(fnameCounty, 'r') as read_obj:
        csv_dict_reader = DictReader(read_obj)

        for row in csv_dict_reader:
            Voter = VoterInfoClass()
            Voter.voterID = row["SOS_VOTERID"]
            Voter.countyID = row["COUNTY_ID"]
            Voter.lastName = row["LAST_NAME"]
            Voter.firstName = row["FIRST_NAME"]
            Voter.dateOfBirth = row["DATE_OF_BIRTH"]
            # Date Format: "1993-06-02"
            Voter.birthYear = Voter.dateOfBirth[:4]
            Voter.zip5 = row["RESIDENTIAL_ZIP"]
            Voter.key = Voter.birthYear + "+" + Voter.zip5

            if (Voter.key not in dictVotersByBirthZip) :
                # new key
                voterList = []
                voterList.append(Voter)
                dictVotersByBirthZip[Voter.key] = voterList

            else :
                # add Voter to list of matches
                voterList = dictVotersByBirthZip[Voter.key]
                voterList.append(Voter)
                dictVotersByBirthZip[Voter.key] = voterList
            # end if

            if (Voter.birthYear not in dictVotersByBirth) :
                # new key
                voterList = []
                voterList.append(Voter)
                dictVotersByBirth[Voter.birthYear] = voterList

            else :
                # add Voter to list of matches
                voterList = dictVotersByBirth[Voter.birthYear]
                voterList.append(Voter)
                dictVotersByBirth[Voter.birthYear] = voterList
            # end if
        # end for each row
    # end read csv
# end county voter files in dir


##################################################
# Read input file
# Lookup BirthYear+zip5 for possible matches
# Check last name for matches
# Write matches to output file
##################################################

with open(fileNameOut, 'w', newline='') as write_csv:
    # field names
    fields = ['row', 'name', 'birth_year']
    fields += ['address', 'city', 'state', 'zip']
    fields += ['matched_voterid']
    # write column headers
    csvwriter = csv.DictWriter(write_csv, fieldnames = fields)
    csvwriter.writeheader()
    rowsOut = []

    with open(fileNameIn, 'r') as read_obj:
        csv_dict_reader = DictReader(read_obj)

        for row in csv_dict_reader:
            # read the line in, save the values for output.
            rowID = row["row"]
            name = row["name"]
            birth_year = row["birth_year"]
            address = row["address"]
            city = row["city"]
            state = row["state"]
            zip5 = row["zip"]
            matched_voterid = ""

            key = birth_year + "+" + zip5
            lastName = parseLastName(name)

            if (key in dictVotersByBirthZip) :
                # MATCH 1: Birth Year + Zip5 + Last Name
                voterList = dictVotersByBirthZip[key]
                matchCount = 0
                for Voter in voterList :
                    # compare name to voter file
                    if matchLastName(lastName, Voter.lastName) :
                        matchCount += 1
                        matched_voterid = Voter.voterID
                        if (matchCount > 1) :
                            # multiple match on last name found
                            # TODO: do 2nd level matching here
                            # reset matched voter id
                            matched_voterid = ""
                        # end matchCount
                    # end matchLastName
                # end for voterList
            elif (birth_year in dictVotersByBirth) :
                # Match 2: Birth Year + Last Name
                voterList = dictVotersByBirth[birth_year]
                matchCount = 0
                for Voter in voterList :
                    # compare name to voter file
                    if matchLastName(lastName, Voter.lastName) :
                        matchCount += 1
                        matched_voterid = Voter.voterID
                        if (matchCount > 1) :
                            # multiple match on last name found
                            # TODO: do 2nd level matching here
                            # reset matched voter id
                            matched_voterid = ""
                        # end matchCount
                    # end matchLastName
                # end for voterList
            # end if key found

            rowOut = {}
            rowOut["row"] = rowID
            rowOut["name"] = name
            rowOut["birth_year"] = birth_year
            rowOut["address"] = address
            rowOut["city"] = city
            rowOut["zip"] = zip5
            rowOut["matched_voterid"] = matched_voterid
            rowsOut.append(rowOut)

        # end for match file

    #Write as CSV file
    csvwriter.writerows(rowsOut)
    print("WRITE file: " + fileNameOut)
# end with write csv
del write_csv
del rowsOut



print("********************************")
print("********************************")
print("********************************")
print("********************************")
print("Finished")

##############################################
# END - Cleanup
#################################################
del dictVotersByBirthZip
del dictVotersByBirth
```