
Driving Distances and Travel Times Using SAS and Google Maps

Presentation to Institutional Research
Council

CUNY, New York

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Presenter:

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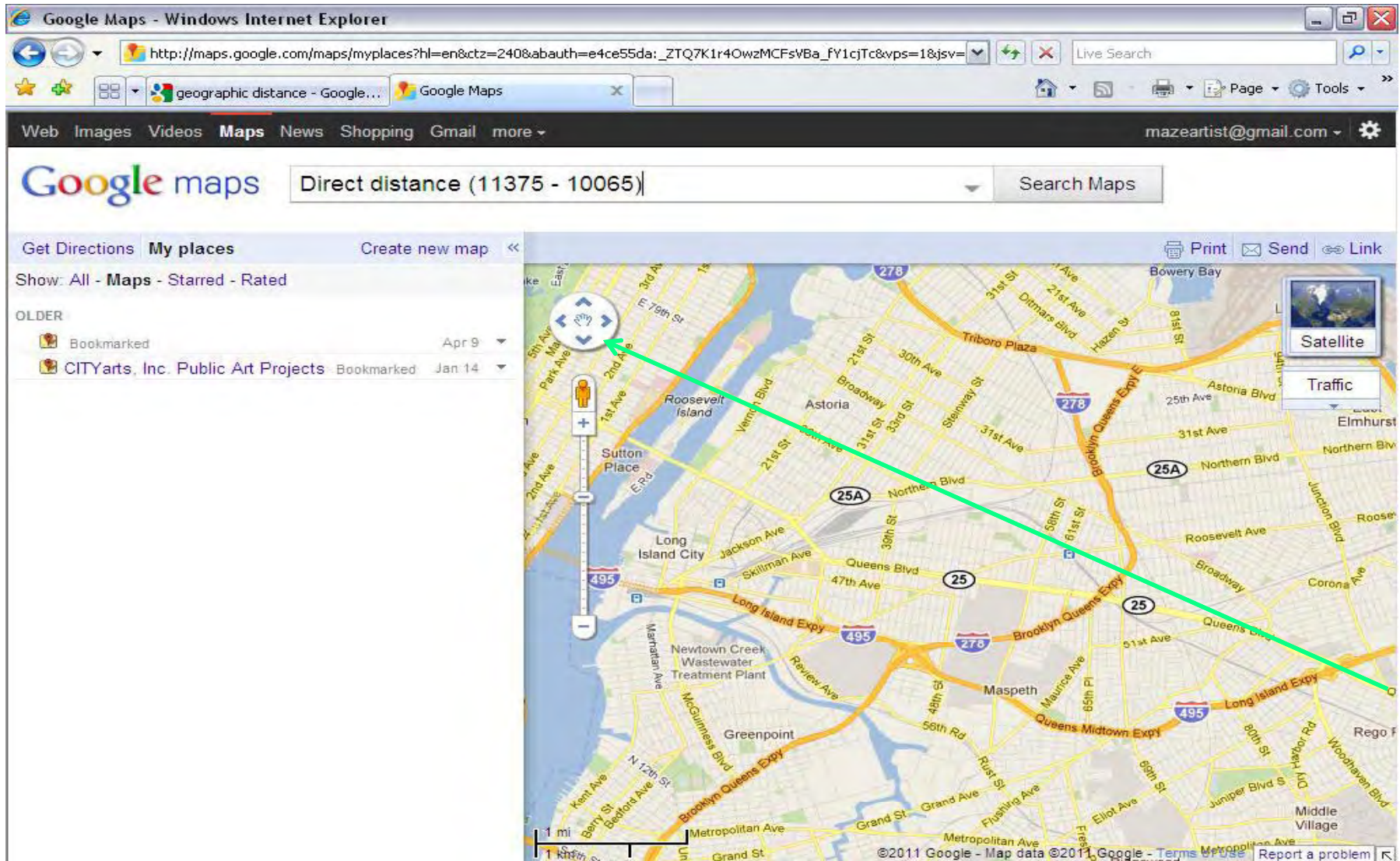
Session Objectives:

- Describe importance and usage of travel time information for the research purposes
 - Describe strategies for accomplishing distance and travel time calculation
 - Discuss pros and cons of using SAS and Google Maps for distances and travel times calculations
-

Information Available from using SAS and Google Maps

- Straight line distance (geographic distance)
 - Driving distance
 - Driving time
 - Public Transit travel time
 - Walking distance and time
 - Bicycling distance and time
-

Straight Line Distance



Straight Line Distance

Input: Zip codes of origin and destination

- Geocodes from SASHELP zipcodes dataset
- Haversine formula calculates great-circle distances between 2 points on a sphere from their longitudes and latitudes

G_distance = 3949.99 * arcos(sin(lat1) * sin(lat2) + cos(lat1) * cos(lat2) * cos(long2 – long1));

Output: straight line distance between centroids of 2 zips

Driving Distance and Time (by zipcode)

FOREST HILLS, NY 11375 to Manhattan, NY 10065 - Google Maps - Windows Internet Explorer

http://maps.google.com/maps?hl=en&tab=wl

FOREST HILLS, NY 11375 to Manhattan, NY 10065 - ...

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A 11375
B 10065
Add Destination - Show options
Get Directions

Driving directions to Manhattan, NY 10065

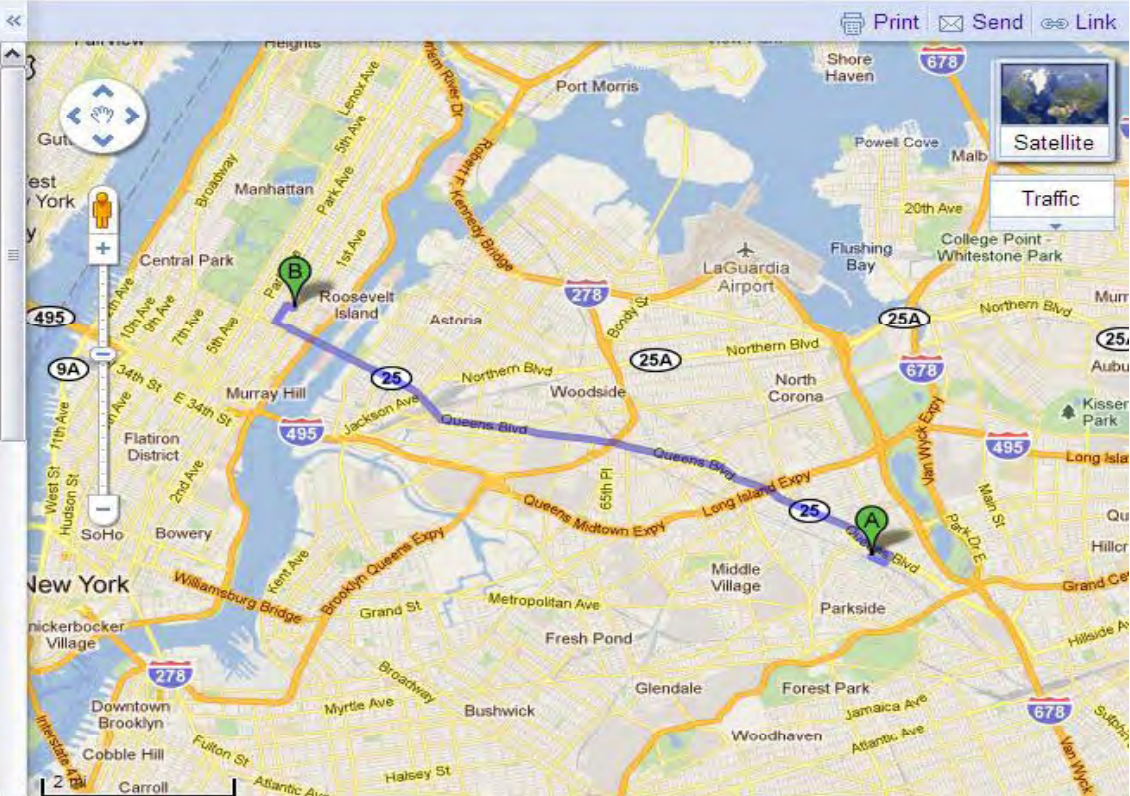
Suggested routes

1. Queens Blvd	19 mins
7.8 mi	
2. I-495 W	20 mins
9.7 mi	
3. Woodhaven Blvd and I-495 W	20 mins
10.2 mi	
Or take Public Transit (Subway)	27 mins

A FOREST HILLS, NY 11375

1. Head southeast on Austin St toward 70th Ave

0.2 mi



The map displays a route from Forest Hills, NY (marked with a green pin 'A') to Manhattan, NY (marked with a green pin 'B'). The route is highlighted in blue and follows Queens Blvd, then I-495 W, and finally Woodhaven Blvd. The map includes labels for various neighborhoods and landmarks, such as Central Park, LaGuardia Airport, and the Queens Midtown Expressway. The map also shows major highways like I-495, I-278, and I-678.

Driving Distance and Time (by address)

67-60 108th St, NY 11375 to 695 Park Ave, Manhattan, NY 10065 - Google Maps - Windows Internet Explorer

http://maps.google.com/maps?hl=en&biw=1003&bih=649&gbv=2&q=geographic%20distance&gs_sm=e&gs_upl=13140119...

67-60 108th St, NY 11375 to 695 Park Ave, Manhatta...

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Car, Transit, Walking, Bicycling

A 6760 108th Street 11375

B 695 Pak ave 10065

Add Destination - Show options

Get Directions

Driving directions to 695 Park Ave, Manhattan, NY 10065

Suggested routes

1. Queens Blvd	19 mins
7.5 mi	
2. I-495 W	20 mins
9.5 mi	
3. I-495 W and 3rd Ave	21 mins
11.5 mi	

Or take Public Transit (Subway) 34 mins

A 67-60 108th St NY 11375

1. Head north on 108th St toward 67th Rd

210 ft

2 kmi

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Public Transit Travel Time

67-60 108th St #6n, NY 11375 to 695 Park Ave, Manhattan, NY 10065 - Google Maps - Windows Internet Explorer

http://maps.google.com/maps?hl=en&biw=1003&bih=649&gbv=2&q=geographic%20distance&gs_sm=e&gs_upl=13140119

67-60 108th St #6n, NY 11375 to 695 Park Ave, Man...

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6760 108th Street apt 6N 11375

695 Pak ave 10065

Add Destination - Show options

Leave now 08/03/11 11:00am

Get Directions

Transit directions to 695 Park Ave, Manhattan, NY 10065

Suggested routes

1. 34 mins
11:03am - 11:37am
2. 34 mins
11:10am - 11:44am
3. 34 mins
11:10am - 11:44am

Or Drive/Taxi 19 mins

67-60 108th St #6n
NY 11375

Basic Steps to Capture Distance/Time

- Prepare input file which consists of pairs of zips, addresses or lat/long coordinates
 - Run a MACRO in a SAS program, which creates FILENAME statement
 - FILENAME statement takes a pair of input parameters, places them into URL to access Google Maps and returns a webpage source
 - Locate distance/time data in the page source file (html)
 - Parse out distance/time data from html
 - Append a new record to the base containing prior address distance/time record
-

Basic Steps to Capture Distance/Time

- Run a MACRO in a SAS program, which creates FILENAME statement

```
* place number of addresses in a macro variable;
data _null_;
call symputx('naddr',obs);
stop;
set addresses nobobs=obs;
run;

* use a loop within a macro to access Google Maps multiple time;
%macro distance_time(type);
.....

%do j=1 %to &naddr;
data _null_;
nrec = &j;
set addresses point=nrec;
call symputx('id',id);
call symputx('a1',translate(trim(addr1),'+',' '));
call symputx('a2',translate(trim(addr2),'+',' '));
stop;
run;

filename x url "http://maps.google.com/maps?daddr=&a1=%nrstr(&saddr)=&a2%nrstr(&dirflg)=&type";
filename z temp;
.....
.....
```


Basic Steps to Capture Distance/Time

- Web page source code (HTML)

```
<!DOCTYPE html><html class="no-maps-mini" xmlns:v="urn:schemas-microsoft-com:vm1"> <head> <meta content=
&&window.external&&(f=window.external.pageT);f&&(window.gmapstiming.pt=f)}catch(g){});})();</script>
hadow:0 1px 5px #ccc}.gbttl .gbm{-moz-box-shadow:1px 1px 1px #ccc}.gbto .gbm{visibility:visible;top:29px
display:-moz-inline-box;display:inline-block;line-height:27px;padding:0;vertical-align:top}.gbt{"display
r,.gbzt:focus,.gbgt-hvr,.gbgt:focus{background-color:#4c4c4c;background-image:none;background-image:non
y:inline}#gbgs5{font-size:0}#gbgs5{padding:5px !important}.gbto #gbgs5{padding:7px 5px 6px !important}#gb
t}.gbm01,.gbm01:visited{color:#000 !important;font-weight:bold}.gbmh{border-top:1px solid #e5e5e5;font-s
r-collapse:collapse;border-spacing:0;margin:0;white-space:normal}#gbpm .gbmt{border-top:none;color:#666
in-top:5px}.lhs-geocode-thumb{cursor:pointer;width:260px;height:80px;background:#fff}#corner-pegman{curs
ar-back{font-size:85%;float:right}.actbar-gray{color:#999}.actbar-sbmt{display:inline;margin:0;padding:0
00}.legal{padding:.2em;padding-top:1em;font-size:85%;color:gray}.legalatop{padding-bottom:1em;color:gra
gn:right;zoom:1}.ca{text-align:center}.a.dtab{zoom:1}.safesearch{margin-top:-4px;border-bottom:10px solid
:21px;height:19px}.hplbc{background:no-repeat url(http://maps.gstatic.com/mapfiles/hpimgs15.png) -84px -
elarrow{width:4px;height:12px}.right-arrow{background:no-repeat url(http://maps.gstatic.com/mapfiles/hpi
idden}div.query{margin-bottom:3px}div.gcpaddr{margin-left:28px;text-align:left}div.gcpaddrnear{color:gra
em}.hp .chdl{padding:0 6px 0 0}.hp .chdlh{font-weight:bold}.hp .mt{margin-top:1.5em}.hp .primg{padding
argin-top:1ex}.n a{color:#4272db}.n .i{font-weight:bold}.i .i:link{color:black}.q:visited,.q:link,.q:act
{background:#ccc;border:0;color:#ccc;height:1px;width:100%}#header{overflow:hidden;width:100%;clear:both
r-style:solid;border-width:1px;padding-right:32px;height:30px}#search .q_d_skunk{-x-system-font:none;bac
ndex:5}#search .skunk-head{position:relative;zoom:1}#search .spacer{clear:both}#search .srchcol{float:le
iles/hpimgs15.png) -27px -115px;width:16px;height:16px}.bar-icon-print-t{background:no-repeat url(http://
px;width:16px;height:16px}.bar-icon-link-static{background:no-repeat url(http://maps.gstatic.com/mapfile
-expand-left3{background:no-repeat url(http://maps.gstatic.com/mapfiles/hpimgs15.png) -2px -61px;width:2
-index:1;overflow:hidden}.flex-startcol #topbar-startcol{position:relative;margin-right:300px}.flex-star
t-bottom;position:relative;top:1px}#topbar #return-to-mapview{position:absolute;right:0}.bar{background:
px;width:7px;height:7px}.rsw-write-review,.rsw-picker-message{white-space:nowrap}.rsw-write-review,.rsw-
dth:13px;height:13px}.rsw-starred{background:no-repeat url(http://maps.gstatic.com/mapfiles/reviews/widg
:left;overflow:hidden}.rsw-aspects #g-name{margin:5px 30px 0 0;width:80px}.rsw-aspects #g-angry,.rsw-aspe
ter;height:12px;width:12px}.rsw-remove-inactive{visibility:hidden}.rsw-remove-active{background:no-repea
return!!a}function n(a,b,c){(c||m)[a]=b;m.bv={n:_tvn("2",0),r:"",m:_tvn("1",1)};var aa=function(){return
var o=function(){},p=function(){},t=function(a){var b=new Image,c=q;b.onerror=b.onload=b.onabort=functio
var u=window.gbar.logger,v={},ba={},w=[],ea=function(a,b){w.push([a,b])},ha=function(a,b){v[a]=b},ia=fun
b,c){if(E){a=t(a,b,b);if(c)for(var d in c)a[d]=c[d];try{E(a)}catch(f){}};n("mdc",v);n("mdi",ba);n("bnc
function _mlToken(a,b){try{if(G<1){G++;var c,d=a,f=b||{};g=encodeURIComponent,h=["//www.google.com/gen_2
c);t(k)}catch(r){}}var H=function(a){return a.length>=2E3,ka=function(a,b){return b};function I(a){o=a
function oa(a){if(window.gapplication)a.href=window.gapplication.getTabUrl(a.href)}
var M=function(){for(var a=[],b=0,c=-1a[b];++b)(c=document.getElementById(c))&&a.push(c);return a},pa=f
document.getElementById(Q);if(h&&h.getAttribute){var l=h.getAttribute("aria-owner");if(l.length){var id=b+
b+"\\b"),d=a.className;return!(d&&d.match(c))},T=function(a){var b,c="direction",d=document.defaultview
for(var h=f.childNodes.length,l=1,i=-1,k=0,r=r[c[k];k++){for(var ca=0,k;k=r[ca];ca++){for(;d<h&&v(f.chil
"gbmt gbmh";L.appendChild(ga);f.insertBefore(L,f.childNodes[i])}m.addHover&&m.addHover(a)}else f.appendc
(P[a]=[]);P[a].push(b)},ta=function(a){a.preventDefault&&a.preventDefault();a.returnValue=j;a.cancelBubb
document.createElement("div");g.innerHTML=f;d.appendChild(g)}else d.innerHTML=b;Y(a,e)}},Y=function(a,
n("dh",o);n("adh",Ea);n("ch",P);n("ach",Fa);n("qs",oa);n("setContinueCb",ma);n("pc",na);var Ia={};v.base
if(_tvv("1")){var Ja=_tvb("false",j);w.push(["gc",{auto:Ja,url:"https://ssl.gstatic.com/gb/js/gcm_340c13
if(_tvv("1")&&_tvv("1")){var $=function(a){Z(function(){yC("pw",a);C("pw",)});n("lpw",$);w.push(["pw",{ur
1;gch;+g}f=f[c[g]]=f[c[g]]||f;return f[c[g]]=d;Pa($,"pw.clk");Pa($,"pw.hvr");n("su",Ma,m.pw)}var Qa=
function Ra(a,b){var c=encodeURIComponent,d=["//www.google.com/gen_204?atyp=i&zx=",{new date}.getTime(),
if(_tvv("1")&&Math.random()<Qa){p=Ra;n("il",p,u);var Sa={};v.il=Sa}var Ta=function(){m.prm&&m.prm()},Ua=
if(_tvb("true",e)){var wa={g:_tvv(""),d:_tvv(""),e:"mazerartist@gmail.com",m:"gmail.com",p:"//lh5.google
```


Basic Steps to Capture Distance/Time

- Locate distance/time data in the page source file (html)
- Parse out distance/time data from html

```
.....
infile z recfm=f lrecl=&filesize. eof=done;

%if &type ^= tr %then %do;
input @ "distance:" @;
input text $50.;
distance = input(scan(text,1,"' "),comma12.);
units     = scan(text,2,"' ");
text      = scan(text,3,"'");
%end;
%else %do;
input @ "Travel time: about" @;
input text $50.;
text = scan(text,2,'<>');
%end;

select;
  when (find(text,'day') ne 0)
    time = 86400*input(scan(text,1,' '),best.)+3600*input(scan(text,3,' '),best.);
  when (find(text,'hour') ne 0)
    time = 3600*input(scan(text,1,' '),best.)+60*input(scan(text,3,' '),best.);
  otherwise
    time = 60*input(scan(text,1,' '),best.);
end;
tr_time=time/60;
output;
```

|

SAS Program Output

VIEWTABLE: Work.Distance_time				
	ADDRESS #1	ADDRESS #2	ID #	TIME (MIN)
16	8315 263RD ST 11004	65-30 KISSENA BLVD	-	49
17	8321 258TH ST 11004	65-30 KISSENA BLVD	-	48
18	8033 255TH ST 11004	65-30 KISSENA BLVD	-	43
19	7810 266TH ST 11004	65-30 KISSENA BLVD	-	42
20	8003 256TH ST 11004	65-30 KISSENA BLVD	-	38
21	8020 266TH ST 11004	65-30 KISSENA BLVD	-	45
22	2505 40TH AVE 11101	65-30 KISSENA BLVD	-	54
23	1136 44TH DR 11101	65-30 KISSENA BLVD	-	51
24	2818 41ST AVE 11101	65-30 KISSENA BLVD	-	51
25	1151 44TH RD 11101	65-30 KISSENA BLVD	-	51
26	1017 47TH AVE 11101	65-30 KISSENA BLVD	-	57
27	3414 43RD ST 11101	65-30 KISSENA BLVD	-	47
28	4444 21ST ST 11101	65-30 KISSENA BLVD	-	50
29	3422 44TH ST 11101	65-30 KISSENA BLVD	-	49
30	3405 44TH ST 11101	65-30 KISSENA BLVD	-	48
31	3607 STEINWAY ST 11101	65-30 KISSENA BLVD	-	49
32	3408 43RD ST 11101	65-30 KISSENA BLVD	-	47
33	PO BOX 1205 11101	65-30 KISSENA BLVD	-	57
34	3721 GREENPOINT AVE 11101	65-30 KISSENA BLVD	-	55
35	1124 46TH AVE 11101	65-30 KISSENA BLVD	-	54
36	3421 37TH ST 11101	65-30 KISSENA BLVD	-	47
37	PO BOX 1594 11101	65-30 KISSENA BLVD	-	57
38	1076 JACKSON AVE 11101	65-30 KISSENA BLVD	-	61
39	1112 47TH AVE. APT 11101	65-30 KISSENA BLVD	-	55
40	4118 VERNON BLVD 11101	65-30 KISSENA BLVD	-	50
41	1146 44TH DR 11101	65-30 KISSENA BLVD	-	50
42	3544 STEINWAY ST 11101	65-30 KISSENA BLVD	-	48
43	2106 45TH AVE 11101	65-30 KISSENA BLVD	-	51
44	3421 37TH ST 11101	65-30 KISSENA BLVD	-	47
45	3114 38TH AVE 11101	65-30 KISSENA BLVD	-	53

Pros and Cons from using SAS and Google Maps

- Automated process
- No complex SAS coding
- Easy testing and checking results
- Usage for various commuting measures

- Substantial amount of time required for large inputs
- Process can't be left unattended for large inputs
- Some SAS code adjustments may be required to follow Google Maps updates
- Google Maps limitations

A Sample Commuting data

Commuting Time

Commuting Time

Table 1. Residency, Distance from College and Average Commute of Hunter Undergraduates (Fall 2008 & Fall 2009)

	All Students	Residency			Avg. Miles from Home Zip to Hunter			Avg. Commuting Time (in minutes) from Home to Hunter		
		New Freshmen	New Transfe	Continuing Students	New Freshm	New Transfers	Continuing Students	New Freshmen	New Transfers	Continuing Students
	27,982	3,818	2,933	21,231	34.1	46.4	16.4	79.2	88.2	55.9
	%	%	%	%						
NYC	<u>78.2</u>	<u>76.5</u>	<u>69.8</u>	<u>79.6</u>	<u>8.1</u>	<u>6.4</u>	<u>7.2</u>	<u>50.4</u>	<u>42.6</u>	<u>45.3</u>
- Bronx	8.1	7.1	8.0	8.3	8.1	7.5	7.8	48.2	43.9	46.1
- Brooklyn	25.4	25.6	21.6	25.8	9.4	8.0	8.8	55.3	49.9	53.1
- Manhattan	15.5	8.9	16.3	16.6	3.0	2.8	3.5	26.4	26.1	26.3
- Queens	25.8	29.8	21.8	25.7	7.2	6.3	6.7	48.8	43.5	45.3
- Staten Island	3.4	5.2	2.1	3.2	15.6	14.7	15.1	78.0	80.3	78.1
NYS	<u>9.7</u>	<u>12.5</u>	<u>12.8</u>	<u>8.8</u>	<u>34.5</u>	<u>42.5</u>	<u>34.6</u>	<u>103.0</u>	<u>110.3</u>	<u>102.2</u>
- Nassau	4.7	6.6	5.3	4.3	22.8	25.5	22.6	95.4	97.0	94.4
- Suffolk	0.9	1.2	1.1	0.9	51.3	50.5	46.5	133.8	128.3	125.7
- Westchester	2.1	2.4	2.7	1.9	22.9	26.5	21.0	72.5	76.4	70.0
- Other	2.0	2.2	3.7	1.8	71.6	76.1	71.5	157.8	164.5	161.3
USA	<u>3.0</u>	<u>3.8</u>	<u>6.5</u>	<u>2.3</u>	<u>614.6</u>	<u>526.7</u>	<u>280.1</u>	<u>832.7</u>	<u>752.3</u>	<u>322.1</u>
- New Jersey	0.9	1.0	1.3	0.8	22.1	20.6	14.5	102.4	88.1	74.5
- Other	2.1	2.8	5.2	1.5	825.4	659.1	417.9	1242.0	975.8	488.3
Foreign	9.1	7.2	10.9	9.2	11.2	20.9	13.3	56.0	59.2	51.2

Summarizing the Benefits of Using SAS and Google Maps for Commuting Times

- Effective tool for collection of commuting times and distance for the population of interest
 - Allows to automate tasks for data extraction
 - No need for special input formatting
 - New version of SAS 9.2 contains new functions that allow user to compute geodesic distance
-

Thank you !
