



The DATA HASH - Not the Monster you Think It Is

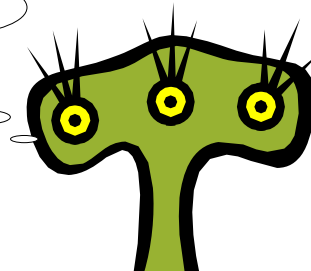
Kay Alden & Jane Stroupe

THE
POWER
TO KNOW®

Agenda

- ☐ What is the DATA step HASH Object?
- ☐ Why would you use it?
- ☐ How do you use it?

Don't let the HASH
object scare you



What is the HASH Object?

You can think of the DATA step hash object as an in-memory table with rows and columns.

The key component

- might consist of numeric and/or character values
- must be unique
- can be composite.

The data component

- can contain multiple data values per key value
- can consist of numeric and character values.

Key	Data	Data

Data and keys are DATA step variables.



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Why would you use a HASH object?



One reason would be to enhance communication.

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Why would you use it?

Table Lookups:

Hash Object: WH

Data set: MyList1

Date	PhoneNum	Acronym
21DEC2006	324-6674	OTOH
21DEC2006	312-5098	JTLYK

Date	PhoneNum	Acronym	Meaning
21DEC2006	324-6674	OTOH	on the other hand
.	.	.	.
.	.	.	.

KEY: Acronym	DATA: Meaning
AFAIK	as far as I know
AFK	away from keyboard
ASAP	as soon as possible
B4N	bye for now
BBL	be back later
BBS	be back soon
BTDT	been there done that
C&G	just to let you know
KISS	keep it simple
LOL	laughing out loud
NP	no problem
NRN	no response necessary
OIC	oh, I see
OTOH	on the other hand
	<lines removed>

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How would you use it?

Example One:

Hash Object: WH

Date	PhoneNum	Acronym	Meaning
21DEC2006	324-6674	BEG	big evil grin
21DEC2006	324-6674	BFN	bye for now
21DEC2006	312-5098	BTDT	been there done that
23DEC2006	389-0098	GA	go ahead
21DEC2006	389-0098	GMTA	great minds think alike
21DEC2006	324-6674	HTH	hope this helps
23DEC2006	389-0098	IOW	in other words
21DEC2006	312-5098	JTLYK	just to let you know
23DEC2006	389-0098	JTLYK	just to let you know
23DEC2006	389-0098	NP	no problem
21DEC2006	324-6674	OIC	oh, I see
21DEC2006	324-6674	OTOH	on the other hand
21DEC2006	312-5098	PM	private message
22DEC2006	312-5098		
23DEC2006	389-0098		
23DEC2006	389-0098		

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A Lookup Example: One Variable

```
data WhatIsIt NotFound;  
  ❶ length Meaning $50;  
  if _n_=1 then do;  
    ❷ declare hash wh(dataset:'Acronyms');  
    ❸ wh.definekey('Acronym');  
    ❹ wh.definedata('Meaning');  
    ❺ wh.definedone();  
  end;  
  set mylist1;  
  ❻ if wh.find() = 0 then output WhatIsIt;  
  else output NotFound;  
run;
```

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Date	PhoneNum	Acronym
21DEC2006	324-6674	OTOH
21DEC2006	312-5098	JTLYK
21DEC2006	312-5098	C&G
21DEC2006	324-6674	OIC
21DEC2006	312-5098	PM

 ~~length Meaning \$50;~~
data WhatIsIt NotFound;
 if _n_=1 then do;
 declare hash wh(dataset:'Acronyms');
 wh.definekey('Acronym');
 wh.definedata('Meaning');
 wh.definedone();
 end;
 set mylist1;
 if wh.find()=0 then output WhatIsIt;
 else output NotFound;
run;

n	Meaning	Date	PhoneNum	Acronym
1		.		

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Date	PhoneNum	Acronym
21DEC2006	324-6674	OTOH
21DEC2006	312-5098	JTLYK
21DEC2006	312-5098	C&G
21DEC2006	324-6674	OIC
21DEC2006	312-5098	PM

```

data WhatIsIt NotFound;
length Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronyms');
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
end;
set mylist1;
if wh.find()=0 then output WhatIsIt;
else output NotFound;
run;

```

n	Meaning	Date	PhoneNum	Acronym
1		.		

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Date	PhoneNum	Acronym
21DEC2006	324-6674	OTOH
21DEC2006	312-5098	JTLYK
21DEC2006	312-5098	C&G
21DEC2006	324-6674	OIC
21DEC2006	312-5098	PM

```

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end;
set mylist1;
if wh.find()=0 then output WhatIsIt;
else output NotFound;
run;

```

n	Meaning	Date	PhoneNum	Acronym
1		17156	324-6674	OTOH

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Date	PhoneNum	Acronym
21DEC2006	324-6674	OTOH
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run;

```

n	Meaning	Date	PhoneNum	Acronym
1		17156	324-6674	OTOH

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Date	PhoneNum	Acronym
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length Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronyms');
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
end;
set mylist1;
if wh.find()=0 then output WhatIsIt;
else output NotFound;
run;

```

True! We found a match

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ASAP	as soon as possible
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21DEC2006	324-6674	OIC
21DEC2006	312-5098	PM

←

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length Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronyms');
  wh.definekey('Acronym');
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end;
set mylist1;
if wh.find()=0 then output WhatIsIt;
else output NotFound;
run;

```

n	Meaning	Date	PhoneNum	Acronym
1	on the other hand	17156	324-6674	OTOH

→

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Date	PhoneNum	Acronym
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21DEC2006	312-5098	JTLYK
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<lines removed>	

```

data WhatIsIt NotFound;
length Meaning $50;
if _n_=1 then do;
  declare hash wh;
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
end;
set mylist1;
if wh.find()=0 then output WhatIsIt;
else output NotFound;
run;

```

ETC.

n	Meaning	Date	PhoneNum	Acronym
1	on the other hand	17156	324-6674	OTOH

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WhatIsIt

Date	PhoneNum	Acronym	Meaning
21DEC2006	324-6674	BEG	big evil grin
21DEC2006	324-6674	BFN	bye for now
21DEC2006	312-5098	BTDT	been there done that
23DEC2006	389-0098	GA	go ahead
22DEC2006	389-0098	GMTA	great minds think alike
22DEC2006	324-6674	HTH	hope this helps
23DEC2006	389-0098	IOW	in other words
21DEC2006	312-5098	JTLYK	just to let you know
23DEC2006	389-0098	JTLYK	just to let you know
23DEC2006	389-0098	NP	no problem
21DEC2006	324-6674	OIC	oh, I see
21DEC2006	324-6674	OTOH	on the other hand
21DEC2006	312-5098	PM	private message
22DEC2006	312-5098	PM	private message
23DEC2006	389-0098	ROTFL	rolling on the floor laughing
23DEC2006	389-0098	WU?	what's up?

NotFound

Date	PhoneNum	Acronym	Meaning
21DEC2006	312-5098	C&G	
22DEC2006	312-5098	MLO	

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Avoiding Nasty Notes



NOTE: Variable Meaning is uninitialized.

```
data WhatIsIt NotFound;
length Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronyms');
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
  call missing(Meaning);
end;
set mylist1;
if wh.find()=0 then output WhatIsIt;
else output NotFound;
run;
```

Use CALL MISSING

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Avoiding Errors



ERROR: Undeclared data symbol Meaning for hash object at line 2024 column 7.
ERROR: DATA STEP Component Object failure. Aborted during the EXECUTION phase.

```
data WhatIsIt NotFound;  
  length Meaning $50;  
  if _n_=1 then do;  
    declare hash wh(dataset:'Acronyms');  
    wh.definekey('Acronym');  
    wh.definedata('Meaning');  
    wh.definedone();  
  end;  
  set mylist1;  
  if wh.find()=0 then output WhatIsIt;  
  else output NotFound;  
run;
```

The DATA and KEY must be DATA step variables.

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Avoiding Errors

```
2274      if wh.find=0 then output WhatIsIt;
```

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ERROR 559-185: Invalid object attribute reference wh.find.

Oops! The parentheses are required.

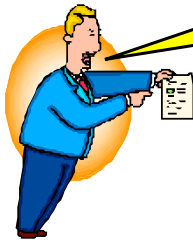


```
data WhatIsIt NotFound;  
  length Meaning $50;  
  if _n_=1 then do;  
    declare hash wh(dataset:'Acronyms');  
    wh.definekey('Acronym');  
    wh.definedata('Meaning');  
    wh.definedone();  
  end;  
  set mylist1;  
  if wh.find()=0 then output WhatIsIt;  
  else output NotFound;  
run;
```

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Avoiding Errors

ERROR: Method defineDone must be called to complete initialization of hash object before line 2286 column 7.
ERROR: DATA STEP Component Object failure. Aborted during the EXECUTION phase.



See what happens if you leave out DEFINEDONE().

```
data _null_;  
    declare hash wh(dataset: 'Acronyms');  
    wh.definekey('Acronym');  
    wh.definedata('Meaning');  
    wh.definedone();  
end;  
set mylist1;  
if wh.find()=0 then output WhatIsIt;  
else output NotFound;  
run;
```

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Avoiding Errors

```
2295      w.definedone();  
-----  
557  
ERROR 557-185: Variable w is not an object.
```

Guess I can't spel.



```
    NotFound;  
    output $50;  
    if then do;  
        declare hash wh(dataset: 'Acronyms');  
        wh.definekey('Acronym');  
        wh.definedata('Meaning');  
        wh.definedone();  
    end;  
set mylist1;  
if wh.find()=0 then output WhatIsIt;  
else output NotFound;  
run;
```

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Why would you use it?

Date	AreaCode	PhoneNum	ToAcronym	From Acronym	To Meaning	FromMeaning
21DEC2006	407	324-6674	OTOH	LOL	on the other hand	laughing out loud
21DEC2006	407	312-5098	JTLYK	OIC	just to let you know	oh, I see
22DEC2006	407	312-5098	C&G	AFAIK	C&G	as far as I know
21DEC2006	407	312-9088	AFAIK	DQMOT	as far as I know	don't quote me on this
21DEC2006	407	324-6674	OIC	IAC	oh, I see	in any case
21DEC2006	407	312-5098	PM	GMTA	private message	great minds think alike
21DEC2006	407	312-5098	BTDT	IHU	been there done that	I hear you
21DEC2006	407	324-6674	BEG	TU	big evil grin	thank you
21DEC2006	407	324-6674	BFN	SYS	bye for now	see you soon
22DEC2006	407	312-5098	MLO	TPTB	MLO	the powers that be
22DEC2006	714	389-0098	GMTA	YUP	great minds think alike	YUP
22DEC2006	714	324-6674	HTH	IHU	hope this helps	I hear you
23DEC2006	714	389-0098	GA	DQMOT	go ahead	don't quote me on this
23DEC2006	714	389-0098	IOW	YBS	in other words	you'll be sorry
23DEC2006	714	389-0098	NP	IMS	no problem	I am sorry
23DEC2006	714	389-0098	WU?	WFM	what's up?	works for me
23DEC2006	714	389-0098	JTLYK	TAFN	just to let you know	that's all for now
23DEC2006	714	389-0098	ROTFL	BBL	rolling on the floor laughing	be back later

A Lookup Example: Two Variables

```

data BothMsg;
  length Acronym $5 Meaning $50;
  if _n_=1 then do;
    declare hash wh(dataset:'Acronyms');
    wh.definekey('Acronym');
    wh.definedata('Meaning');
    wh.definedone();
  end;
  set mylist2;
  rc=wh.find(key:ToAcronym);
  if rc=0 then ToMeaning=Meaning;
  else ToMeaning=ToAcronym;
  rc=wh.find(key:FromAcronym);
  if rc=0 then FromMeaning=Meaning;
  else FromMeaning=FromAcronym;
run;

```

Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK

T

```

data BothMsg;
length Acronym $5 Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronyms');
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=ToAcronym;
rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
else FromMeaning=FromAcronym;
run;

```


KEY:Acronym	DATA: Meaning
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AFK	away from keyboard
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B4N	bye for now
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BBS	be back soon
BEG	big evil grin
	<lines removed>
JTLYK	just to let you know
KISS	keep it simple
LOL	laughing out loud
NP	no problem
NRN	no response necessary
OIC	oh, I see
OTOH	on the other hand
	<lines removed>

n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1			.						

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Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK


```

data BothMsg;
length Acronym $5 Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronyms');
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=ToAcronym;
rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
else FromMeaning=FromAcronym;
run;

```


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	<lines removed>

n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1			17156	324-6674	OTOH	LOL			

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Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK

```

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length Acronym $5 Meaning $50;
if _n_=1 then do;
declare hash wh(dataset:'Acronyms');
wh.definekey('Acronym');
wh.definedata('Meaning');
wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=ToAcronym;
rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
else FromMeaning=FromAcronym;
run;

```

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n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1			17156	324-6674	OTOH	LOL	0		

27

Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK

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wh.definedone();
end;
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if rc=0 then ToMeaning=Meaning;
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rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
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run;

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1		on the other hand	17156	324-6674	OTOH	LOL	0		

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Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK

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if _n_=1 then do;
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wh.definekey('Acronym');
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wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
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if rc=0 then FromMeaning=Meaning;
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AFK	away from keyboard
ASAP	as soon as possible
B4N	bye for now
BBL	be back later
BBS	be back soon
BEG	big evil grin
<lines removed>	
JTLYK	just to let you know
KISS	keep it simple
LOL	laughing out loud
NP	no problem
NRN	no response necessary
OIC	oh, I see
OTOH	on the other hand
<lines removed>	

n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1		on the other hand	17156	324-6674	OTOH	LOL	0		

29

Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK

```

data BothMsg;
length Acronym $5 Meaning $50;
if _n_=1 then do;
declare hash wh(dataset:'Acronyms');
wh.definekey('Acronym');
wh.definedata('Meaning');
wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=ToAcronym;
rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
else FromMeaning=FromAcronym;
run;

```

KEY:Acronym	DATA: Meaning
AFAIK	as far as I know
AFK	away from keyboard
ASAP	as soon as possible
B4N	bye for now
BBL	be back later
BBS	be back soon
BEG	big evil grin
<lines removed>	
JTLYK	just to let you know
KISS	keep it simple
LOL	laughing out loud
NP	no problem
NRN	no response necessary
OIC	oh, I see
OTOH	on the other hand
<lines removed>	

n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1		on the other hand	17156	324-6674	OTOH	LOL	0	on the other hand	

30

Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK

```

data BothMsg;
length Acronym $5 Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronyms');
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=ToAcronym;
rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
else FromMeaning=FromAcronym;
run;

```

KEY:Acronym	DATA: Meaning
AFAIK	as far as I know
AFK	away from keyboard
ASAP	as soon as possible
B4N	bye for now
BBL	be back later
BBS	be back soon
BEG	big evil grin
<lines removed>	
JTLYK	just to let you know
KISS	keep it simple
LOL	laughing out loud
NP	no problem
NRN	no response necessary
OIC	oh, I see
OTOH	on the other hand
<lines removed>	

n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1		on the other hand	17156	324-6674	OTOH	LOL	0	on the other hand	

31

Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	AFAIK
21DEC2006	312-5098	C&G	AFAIK

```

data BothMsg;
length Acronym $5 Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronyms');
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=ToAcronym;
rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
else FromMeaning=FromAcronym;
run;

```

KEY:Acronym	DATA: Meaning
AFAIK	as far as I know
AFK	away from keyboard
ASAP	as soon as possible
B4N	bye for now
BBL	be back later
BBS	be back soon
BEG	big evil grin
<lines removed>	
JTLYK	just to let you know
KISS	keep it simple
LOL	laughing out loud
NP	no problem
NRN	no response necessary
OIC	oh, I see
OTOH	on the other hand
<lines removed>	

n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1		laughing out loud	17156	324-6674	OTOH	LOL	0	on the other hand	

32

Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK

```

data BothMsg;
length Acronym $5 Meaning $50;
if _n_=1 then do;
declare hash wh(dataset:'Acronyms');
wh.definekey('Acronym');
wh.definedata('Meaning');
wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=ToAcronym;
rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
else FromMeaning=FromAcronym;
run;

```

KEY:Acronym	DATA: Meaning
AFAIK	as far as I know
AFK	away from keyboard
ASAP	as soon as possible
B4N	bye for now
BBL	be back later
BBS	be back soon
BEG	big evil grin
<lines removed>	
JTLYK	just to let you know
KISS	keep it simple
LOL	laughing out loud
NP	no problem
NRN	no response necessary
OIC	oh, I see
OTOH	on the other hand
<lines removed>	

n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1		laughing out loud	17156	324-6674	OTOH	LOL	0	on the other hand	

33

Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK

```

data BothMsg;
length Acronym $5 Meaning $50;
if _n_=1 then do;
declare hash wh(dataset:'Acronyms');
wh.definekey('Acronym');
wh.definedata('Meaning');
wh.definedone();
end;
set mylist2;
rc=wh.find(key:ToAcronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=ToAcronym;
rc=wh.find(key:FromAcronym);
if rc=0 then FromMeaning=Meaning;
else FromMeaning=FromAcronym;
run;

```

KEY:Acronym	DATA: Meaning
AFAIK	as far as I know
AFK	away from keyboard
ASAP	as soon as possible
B4N	bye for now
BBL	be back later
BBS	be back soon
BEG	big evil grin
<lines removed>	
JTLYK	just to let you know
KISS	keep it simple
LOL	laughing out loud
NP	no problem
NRN	no response necessary
OIC	oh, I see
OTOH	on the other hand
<lines removed>	

n	Acronym	Meaning	Date	PhoneNum	ToAcronym	FromAcronym	rc	ToMeaning	FromMeaning
1		laughing out loud	17156	324-6674	OTOH	LOL	0	on the other hand	laughing out loud

34

Date	PhoneNum	ToAcronym	FromAcronym
21DEC2006	324-6674	OTOH	LOL
21DEC2006	312-5098	JTLYK	OIC
21DEC2006	312-5098	C&G	AFAIK


```

data BothMsg;
length Acronym $5 Meaning $50;
if _n_=1 then do;
  declare hash wh(dataset:'Acronym');
  wh.definekey('Acronym');
  wh.definedata('Meaning');
  wh.definedone();
end;
set mylist;
rc=wh.find(Acronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning=wh.find(key:Acronym);
if rc=0 then ToMeaning=Meaning;
else ToMeaning='';
run;

```


KEY:Acronym	DATA: Meaning
AFAIK	as far as I know
AFK	away from keyboard
SAP	as soon as possible
BYE	bye for now
BL	be back later
BS	be back soon
EC	big evil grin
<lines removed>	
LOL	laughing out loud
NO PROBLEM	no problem
NRN	no response necessary
OH, I SEE	oh, I see
OTOH	on the other hand
<lines removed>	

n	Acronym	Meaning	Date	Area Code	Phone Num	To Acronym	From Acronym	rc	ToMeaning	FromMeaning
1		laughing out loud	21DEC2006	407	324-6674	OTOH	LOL	0	on the other hand	laughing out loud

ETC.

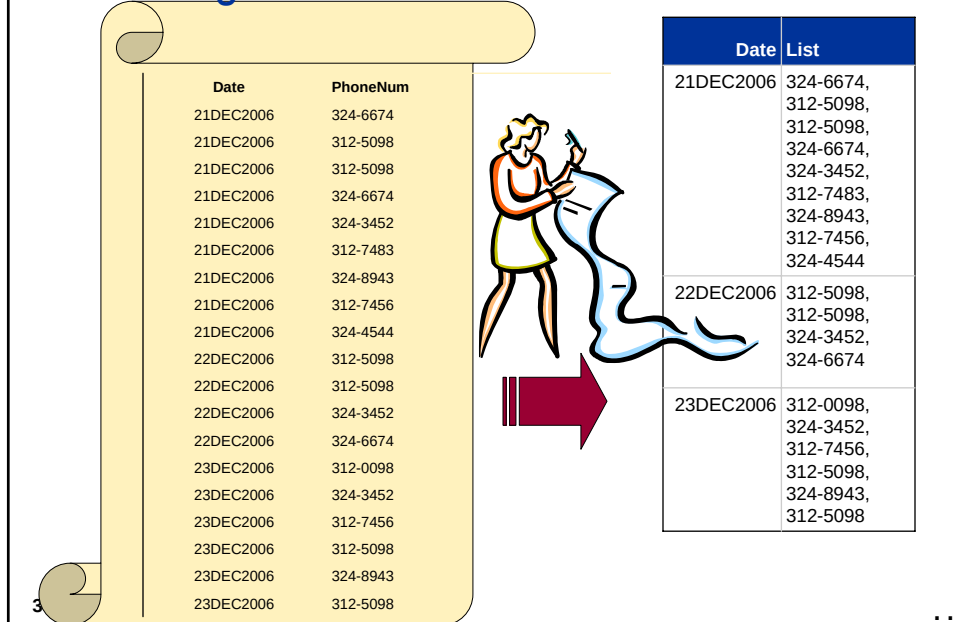
35

So what's the result?

Acronym	Meaning	Date	Area Code	Phone Num	To Acronym	From Acronym	rc	ToMeaning	FromMeaning
	laughing out loud	21DEC2006	407	324-6674	OTOH	LOL	0	on the other hand	laughing out loud
	oh, I see	21DEC2006	407	312-5098	JTLYK	OIC	0	just to let you know	oh, I see
	as far as I know	22DEC2006	407	312-5098	C&G	AFAIK	0	C&G	as far as I know
	don't quote me on this	21DEC2006	407	312-9088	AFAIK	DQMOT	0	as far as I know	don't quote me on this
	in any case	21DEC2006	407	324-6674	OIC	IAC	0	oh, I see	in any case
	great minds think alike	21DEC2006	407	312-5098	PM	GMTA	0	private message	great minds think alike
	I hear you	21DEC2006	407	312-5098	BTDT	IHU	0	been there done that	I hear you
	thank you	21DEC2006	407	324-6674	BEG	TU	0	big evil grin	thank you
	see you soon	21DEC2006	407	324-6674	BFN	SYS	0	bye for now	see you soon
	the powers that be	22DEC2006	407	312-5098	MLO	TPTB	0	MLO	the powers that be
	great minds think alike	22DEC2006	714	389-0098	GMTA	YUP	-2147450842	great minds think alike	YUP
	I hear you	22DEC2006	714	324-6674	HTH	IHU	0	hope this helps	I hear you
	don't quote me on this	23DEC2006	714	389-0098	GA	DQMOT	0	go ahead	don't quote me on this
	you'll be sorry	23DEC2006	714	389-0098	IOW	YBS	0	in other words	you'll be sorry
	I am sorry	23DEC2006	714	389-0098	NP	IMS	0	no problem	I am sorry
	works for me	23DEC2006	714	389-0098	WU?	WFM	0	what's up?	works for me
	that's all for now	23DEC2006	714	389-0098	JTLYK	TAFN	0	just to let you know	that's all for now
	be back later	23DEC2006	714	389-0098	ROTFL	BBL	0	rolling on the floor laughing	be back later

36

Creating a List



Here's the program:

```

data _null_;
  length List $100;
  if _n_=1 then do;
    declare hash ph();
    ph.DefineKey('Date');
    ❶ ph.DefineData('Date','List');
    ph.DefineDone();
  end;
  set PhoneCalls end=last;
  if ph.find() ne 0 then do;
    ❷ List=PhoneNum;
    ❸ ph.add();
  end;
  else do;
    ❹ List=trim(List)||', '||PhoneNum;
    ❺ ph.replace();
  end;
  if last then
    ❻ ph.output(dataset:'PhoneList');
run;

```

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

```

data _null_;
  length List $100;
  if _n_=1 then do;
    declare hash ph();
    ph.DefineKey('Date');
    ph.DefineData('Date','List');
    ph.DefineDone();
  end;
  set PhoneCalls end=last;
  if ph.find() ne 0 then do;
    List=PhoneNum;
    ph.add();
  end;
  else do;
    List=trim(List)||', '||PhoneNum;
    ph.replace();
  end;
  if last then
    ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
1		.		0

39

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List



```

data _null_;
length List $100;
  if _n_=1 then do;
    declare hash ph();
    ph.DefineKey('Date');
    ph.DefineData('Date','List');
    ph.DefineDone();
  end;
  set PhoneCalls end=last;
  if ph.find() ne 0 then do;
    List=PhoneNum;
    ph.add();
  end;
  else do;
    List=trim(List)||', '||PhoneNum;
    ph.replace();
  end;
  if last then
    ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
1		.		0

40

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
1		21DEC2006	324-6674	0

41

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
1		21DEC2006	324-6674	0

42

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

?

KEY: Date	DATA: Date	DATA: List

```

data _null_;
length List $100;
if _n_=1 then do;
  declare hash ph();
  ph.DefineKey('Date');
  ph.DefineData('Date','List');
  ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
  List=PhoneNum;
  ph.add();
end;
else do;
  List=trim(List)||', '||PhoneNum;
  ph.replace();
end;
if last then
  ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
1		21DEC2006	324-6674	0

43

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

?

KEY: Date	DATA: Date	DATA: List

```

data _null_;
length List $100;
if _n_=1 then do;
  declare hash ph();
  ph.DefineKey('Date');
  ph.DefineData('Date','List');
  ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
  List=PhoneNum;
  ph.add();
end;
else do;
  List=trim(List)||', '||PhoneNum;
  ph.replace();
end;
if last then
  ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
1		21DEC2006	324-6674	0

44

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
1	324-6674	21DEC2006	324-6674	0

45

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
1	324-6674	21DEC2006	324-6674	0

46

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

```

data _null_;
length List $100;
if _n_=1 then do;
  declare hash ph();
  ph.DefineKey('Date');
  ph.DefineData('Date','List');
  ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
  List=PhoneNum;
  ph.add();
end;
else do;
  List=trim(List)||', '||PhoneNum;
  ph.replace();
end;
if last then
  ph.output(dataset:'PhoneList');
run;

```

n	List	Date	PhoneNum	Last
1	324-6674	21DEC2006	324-6674	0

47

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

```

data _null_;
length List $100;
if _n_=1 then do;
  declare hash ph();
  ph.DefineKey('Date');
  ph.DefineData('Date','List');
  ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
  List=PhoneNum;
  ph.add();
end;
else do;
  List=trim(List)||', '||PhoneNum;
  ph.replace();
end;
if last then
  ph.output(dataset:'PhoneList');
run;

```

n	List	Date	PhoneNum	Last
1	324-6674	21DEC2006	324-6674	0

48

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

F

```

data _null_;
length List $100;
if _n_=1 then do;
  declare hash ph();
  ph.DefineKey('Date');
  ph.DefineData('Date','List');
  ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
  List=PhoneNum;
  ph.add();
end;
else do;
  List=trim(List)||', '||PhoneNum;
  ph.replace();
end;
if last then
  ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
2		21DEC2006	324-6674	0

49

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

→

```

data _null_;
length List $100;
if _n_=1 then do;
  declare hash ph();
  ph.DefineKey('Date');
  ph.DefineData('Date','List');
  ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
  List=PhoneNum;
  ph.add();
end;
else do;
  List=trim(List)||', '||PhoneNum;
  ph.replace();
end;
if last then
  ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
2		21DEC2006	312-5098	0

50

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

```

data _null_;
  length List $100;
  if _n_=1 then do;
    declare hash ph();
    ph.DefineKey('Date');
    ph.DefineData('Date','List');
    ph.DefineDone();
  end;
  set PhoneCalls end=last;
  if ph.find() ne 0 then do;
    List=PhoneNum;
    ph.add();
  end;
  else do;
    List=trim(List)||', '||PhoneNum;
    ph.replace();
  end;
  if last then
    ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
2		21DEC2006	312-5098	0

51

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

```

data _null_;
  length List $100;
  if _n_=1 then do;
    declare hash ph();
    ph.DefineKey('Date');
    ph.DefineData('Date','List');
    ph.DefineDone();
  end;
  set PhoneCalls end=last;
  if ph.find() ne 0 then do;
    List=PhoneNum;
    ph.add();
  end;
  else do;
    List=trim(List)||', '||PhoneNum;
    ph.replace();
  end;
  if last then
    ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
2		21DEC2006	312-5098	0

52

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
2		21DEC2006	312-5098	0

53

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
2		21DEC2006	312-5098	0

54

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098

```

data _null_;
  length List $100;
  if _n_=1 then do;
    declare hash ph();
    ph.DefineKey('Date');
    ph.DefineData('Date','List');
    ph.DefineDone();
  end;
  set PhoneCalls end=last;
  if ph.find() ne 0 then do;
    List=PhoneNum;
    ph.add();
  end;
  else do;
    List=trim(List)||', '||PhoneNum;
    ph.replace();
  end;
  if last then
    ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
2	324-6674, 312-5098	21DEC2006	312-5098	0

55

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674

```

data _null_;
  length List $100;
  if _n_=1 then do;
    declare hash ph();
    ph.DefineKey('Date');
    ph.DefineData('Date','List');
    ph.DefineDone();
  end;
  set PhoneCalls end=last;
  if ph.find() ne 0 then do;
    List=PhoneNum;
    ph.add();
  end;
  else do;
    List=trim(List)||', '||PhoneNum;
    ph.replace();
  end;
  if last then
    ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
2	324-6674, 312-5098	21DEC2006	312-5098	0

56

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098
22DEC2006	22DEC2006	312-5098, 312-5098
23DEC2006	23DEC2006	389-0098, 324-3452.....

```

data _null_;
  length List $100;
  if _n_=1 then do;
    declare hash ph(Define);
  end;
  set PhoneCalls end=last;
  if last then do;
    ph.output(dataset:'PhoneList');
  end;
  else do;
    List=trim(List)||'|'||PhoneNum;
    ph.add();
  end;
run;

```

continue reading PhoneCalls until the last observation

n	List	Date	PhoneNum	Last
18		23DEC2006	312-7456	0

57

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098
22DEC2006	22DEC2006	312-5098, 312-5098
23DEC2006	23DEC2006	389-0098, 324-3452.....

```

data _null_;
  length List $100;
  if _n_=1 then do;
    declare hash ph();
    ph.definekey('Date');
    ph.definelist('List');
    ph.defineDone();
  end;
  set PhoneCalls end=last;
  if ph.find() ne 0 then do;
    List=PhoneNum;
    ph.add();
  end;
  else do;
    List=trim(List)||'|'||PhoneNum;
    ph.replace();
  end;
  if last then
    ph.output(dataset:'PhoneList');
run;

```

F

n	List	Date	PhoneNum	Last
19		23DEC2006	312-7456	0

58

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098
22DEC2006	22DEC2006	312-5098, 312-5098
23DEC2006	23DEC2006	389-0098, 324-3452

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
19		23DEC2006	389-0098	1

59

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098
22DEC2006	22DEC2006	312-5098, 312-5098
23DEC2006	23DEC2006	389-0098, 324-3452

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
19		23DEC2006	389-0098	1

60

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098
22DEC2006	22DEC2006	312-5098, 312-5098
23DEC2006	23DEC2006	389-0098, 324-3452


```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;
  
```

F

n	List	Date	PhoneNum	Last
19		23DEC2006	389-0098	1

61

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098
22DEC2006	22DEC2006	312-5098, 312-5098
23DEC2006	23DEC2006	389-0098, 324-3452


```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;
  
```

n	List	Date	PhoneNum	Last
19	389-0098, 324-3452	23DEC2006	389-0098	1

62

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098
22DEC2006	22DEC2006	312-5098, 312-5098
23DEC2006	23DEC2006	389-0098, 324-3452

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

n	List	Date	PhoneNum	Last
19	389-0098, 324-3452	23DEC2006	389-0098	1

63

Date	PhoneNum
21DEC2006	324-6674
21DEC2006	312-5098
21DEC2006	312-5098
21DEC2006	324-6674

KEY: Date	DATA: Date	DATA: List
21DEC2006	21DEC2006	324-6674, 312-5098
22DEC2006	22DEC2006	312-5098, 312-5098
23DEC2006	23DEC2006	389-0098, 324-3452

```

data _null_;
length List $100;
if _n_=1 then do;
declare hash ph();
ph.DefineKey('Date');
ph.DefineData('Date','List');
ph.DefineDone();
end;
set PhoneCalls end=last;
if ph.find() ne 0 then do;
List=PhoneNum;
ph.add();
end;
else do;
List=trim(List)||', '||PhoneNum;
ph.replace();
end;
if last then
ph.output(dataset:'PhoneList'
run;

```

Work.PhoneList

Date	List
21DEC2006	324-6674, 312-5098, 312-5098,
22DEC2006	312-5098, 312-5098, 324-3452,
23DEC2006	389-0098, 324-3452, 312-7456,

n	List	Date	PhoneNum	Last
19	389-0098, 324-3452	23DEC2006	389-0098	1

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What happens if

There are duplicate keys?

- loading the hash object with the DATASET: when there are duplicates in the data set, the first observation with the key value is loaded, and there is no message in the log.
- using the ADD method
 - o if the return code of ADD is not assigned to a variable, there is a duplicate key error output to the SAS log
 - o if the return code is assigned to a variable, the variable is assigned a non-zero value, and the error is not output to the log.

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What happens if

The hash object uses up all the memory?

The load fails.

To avoid this:

- Place as little data in the hash object as possible.
- Use codes for the key and data items so they are as small as possible.
- If the hash object only needs to contain a subset of the observations of a data set, create a view that references only the subset.

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Advantages of Hash Objects

Advantages of using hash objects include the following:

- use of character and numeric keys
- use of composite keys
- ability for faster lookup
- ability to be loaded from a SAS data set
- fine level of control (flexibility)
- ability to do chained lookups
- avoidance of sorting and multiple merges

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Disadvantages of Hash Objects

Disadvantages of using a hash object include the following:

- unique keys required
- DATA step only

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Questions?

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