PET OWNERSHIP VS MEAT CONSUMPTION

- Anand Mahadevan -Arzhang Valadkhani -Brent Sakihara -Aaron Liu -Omar Ochoa

1) What information do we have?

- Person gender, num. pets owned, the types of pets owned, the types of meat eaten, reason for not eating atleast one type of meat.

2) What would you like to know?

- We would like to know about pet ownership rate, meat consumption rate, and gender related to both those variables.

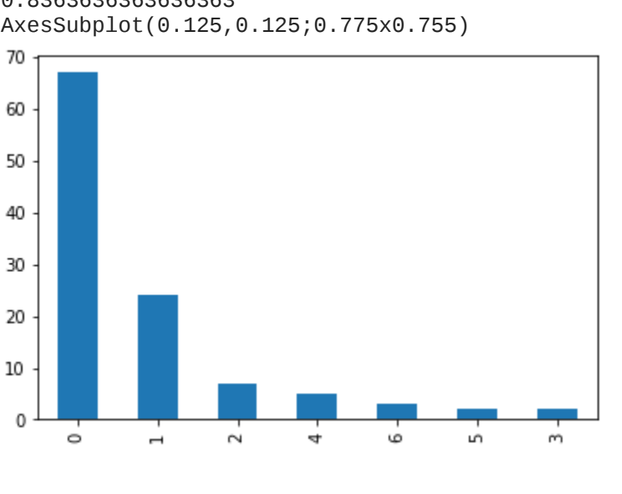
Answer Questions 1, 2. • Question3: Explain what you are computing (mean, SD, ...), and then compute using Python. Create some visualizations (at least 5, and at least 3 must be of different types). • Answer Question 4. State clearly each of your hypotheses (at least 3). • Question 5: Test your hypotheses and predictions (use at least 3 different tests). For each: describe the method you are using; perform it; analyze the results and draw the conclusion.

In [1]:
```
from scipy.stats import chi2_contingency
import pandas as pd
df = pd.read_csv("PetVsMeat.csv")
#data collected from PHYS0408 class, CS105 (us), and CS111
```

VISUALIZATIONS START HERE

In [2]:
```
# Frequency of Pets owned
numpet = df["NumPets"]
#print(numpet)
print(numpet.mean())
print(numpet.value_counts().plot.bar())
```

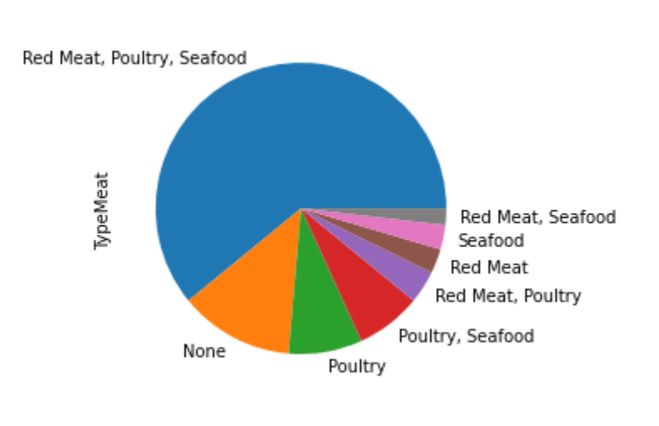
```
0.8363636363636363
AxesSubplot(0.125,0.125;0.775x0.755)
```



Conclusion.. It appears as though the vast majority of people surveyed do not own a pet. The mean number of pets owned is 0.8.

In [3]:
```
#pie chart visualization of the distribution of meats that the sample has eaten
df["TypeMeat"].value_counts().plot(kind="pie")
```

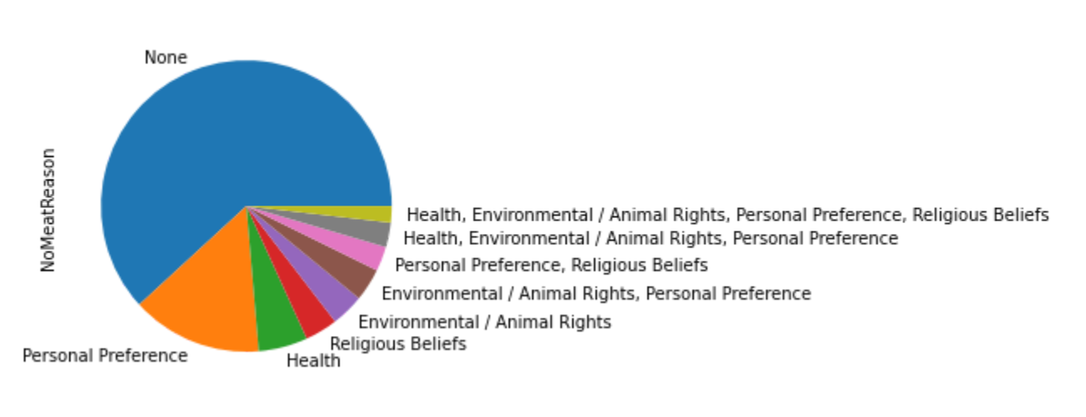
Out[3]: <AxesSubplot:ylabel='TypeMeat'>



Conclusion... The majority of people surveyed eat all types of meat, the highest being Vegetarian (None), and just poultry third.

In [4]:
```
# Pie chart of No Meat Reason
NoMeatReason = df["NoMeatReason"]
NoMeatReason.value_counts().plot.pie()
```

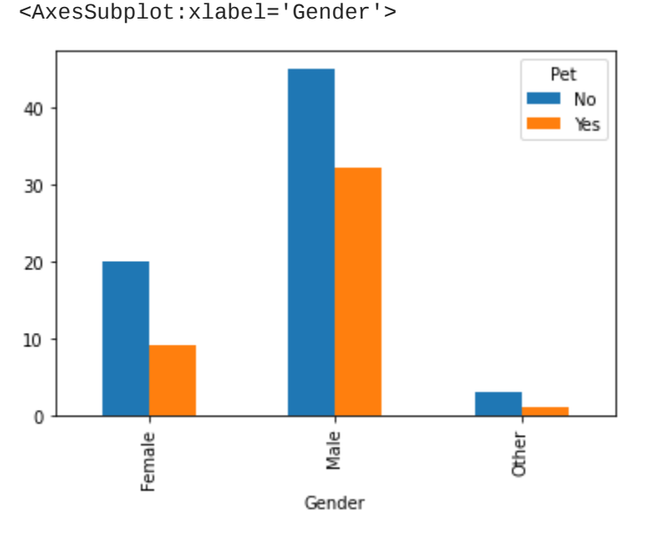
Out[4]: <AxesSubplot:ylabel='NoMeatReason'>



Conclusion.. The largest reason why people don't eat atleast one type of meat is Personal Preference. The majority of people don't have a reason to not eat meat because they eat all types of meat.

In [5]:
```
#bar graph of the pet ownership by each gender
pd.crosstab(df["Gender"], df["Pet"]).plot(kind="bar")
```

Out[5]: <AxesSubplot:xlabel='Gender'>

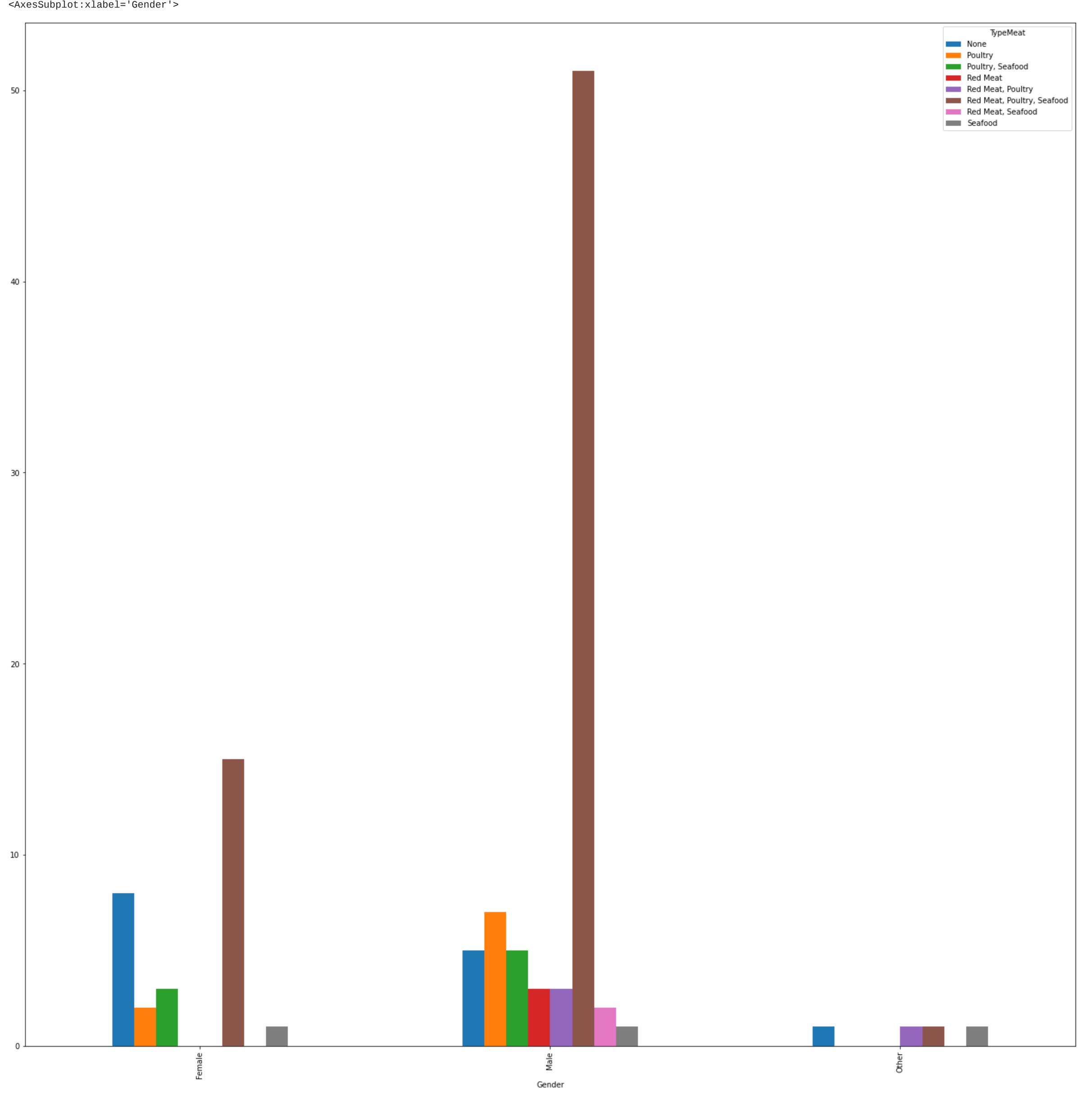


Conclusion.. For every gender, there are more people who don't own a pet than people who do. It appears, however, that there is a larger % of male people who do own a pet, than female people who own a pet.

In [6]:
```
# Visualization of Gender vs Meat Type
gender_meat = pd.crosstab(df['Gender'], df['TypeMeat'])
display(gender_meat)
gender_meat.plot.bar(figsize = (25,25))
```

TypeMeat Gender	None	Poultry	Poultry, Seafood	Red Meat	Red Meat, Poultry	Red Meat, Poultry, Seafood	Red Meat, Seafood	Seafood
Female	8	2	3	0	0	15	0	1
Male	5	7	5	3	3	51	2	1
Other	1	0	0	0	1	1	0	1

Out[6]: <AxesSubplot:xlabel='Gender'>

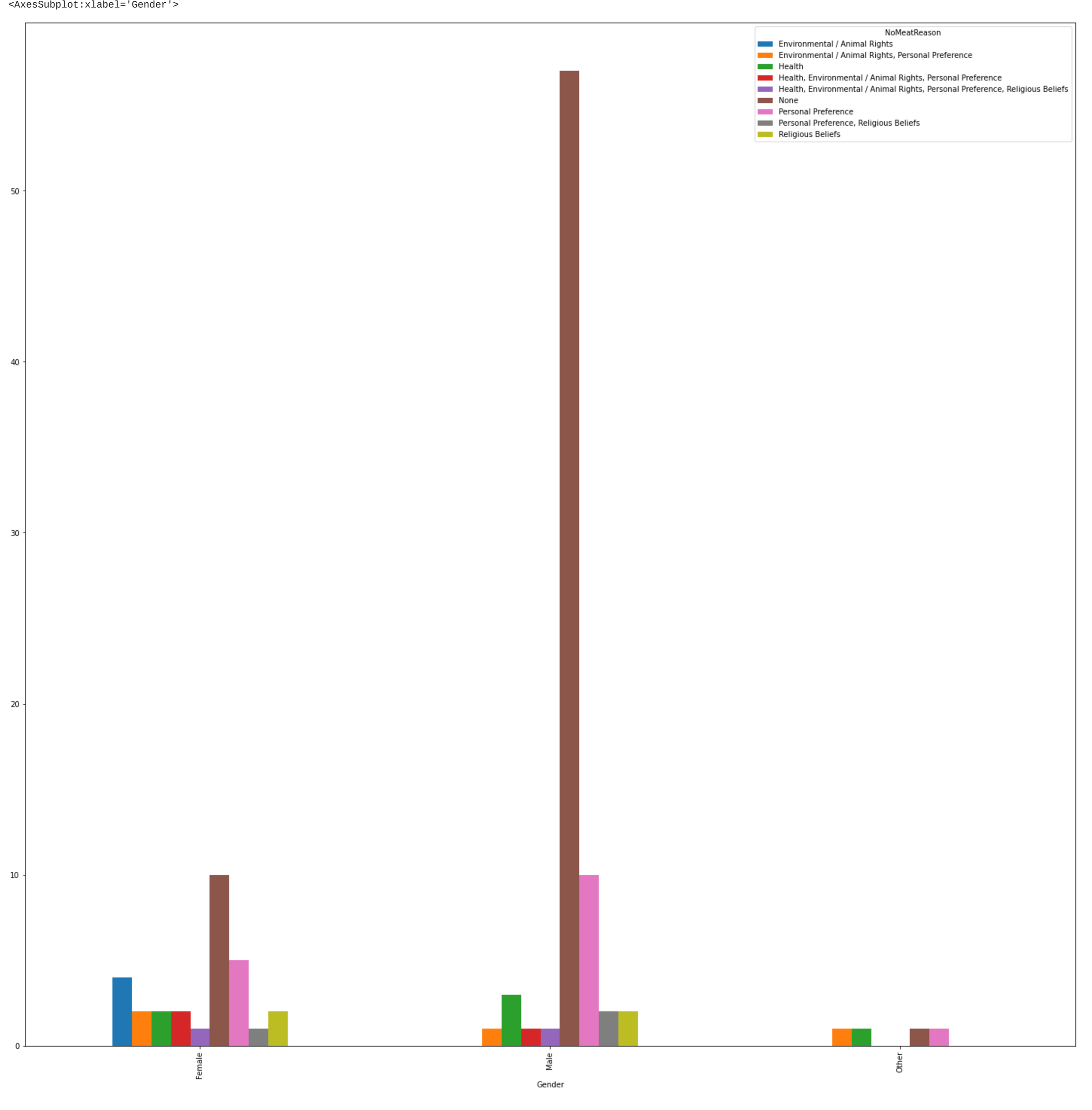


Conclusion... There is an overwhemingly large amount of males who eat all types of meat. In terms of females, while the greatest category was also eating all types of meat, there was a noticable secondary category of vegetarian females.

In [7]:
```
# Visualization of Gender vs NoMeatReason
gender_nomeat = pd.crosstab(df['Gender'], df['NoMeatReason'])
display(gender_nomeat)
gender_nomeat.plot.bar(figsize = (25,25))
```

NoMeatReason Gender	Environmental / Animal Rights	Environmental / Animal Rights, Personal Preference	Health	Health, Environmental / Animal Rights, Personal Preference	Health, Environmental / Animal Rights, Personal Preference, Religious Beliefs	None	Personal Preference	Personal Preference, Religious Beliefs	Religious Beliefs
Female	4	2	2	2	1	10	5	1	2
Male	0	1	3	1	1	57	10	2	2
Other	0	1	1	0	0	1	1	0	0

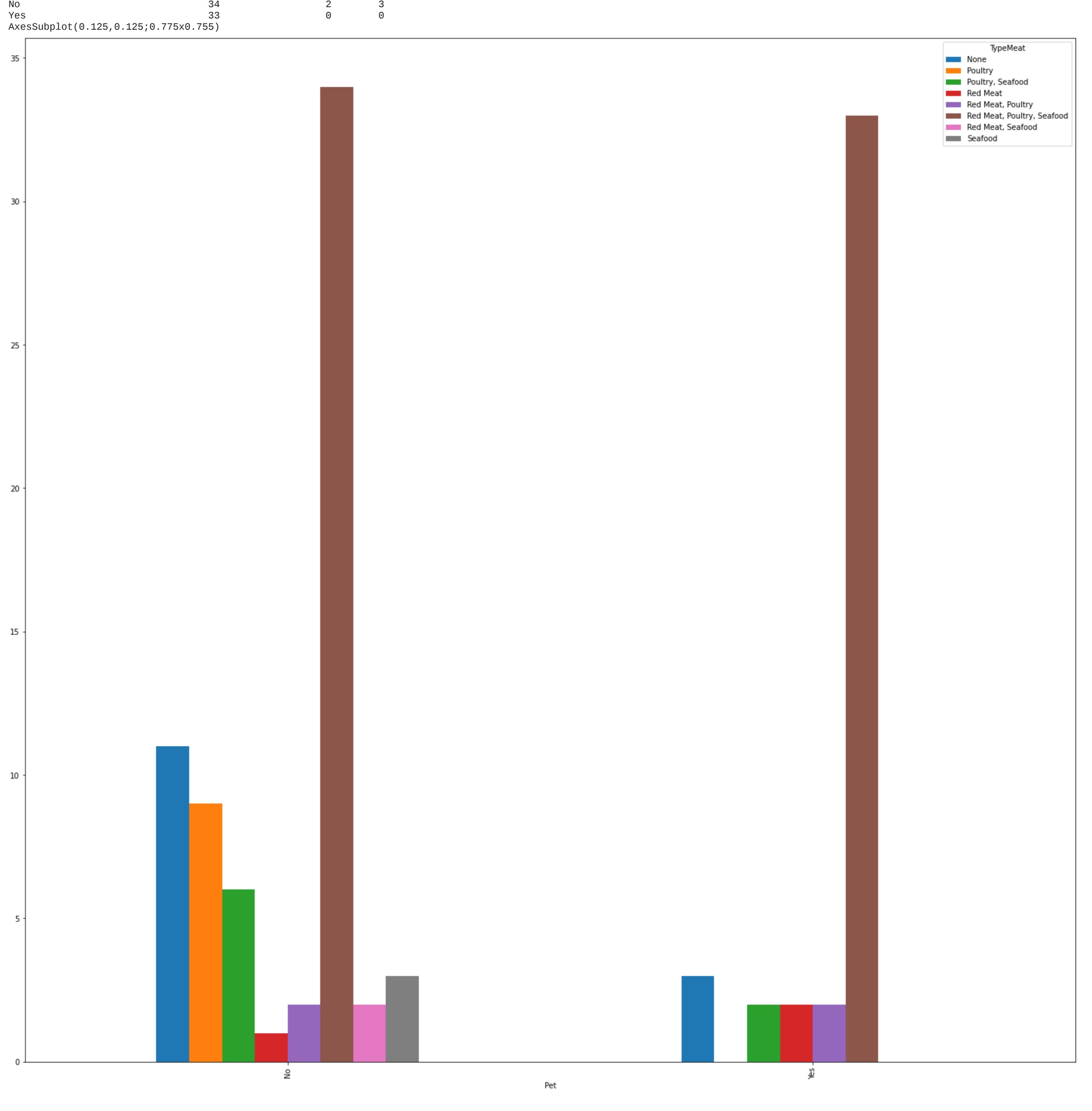
Out[7]: <AxesSubplot:xlabel='Gender'>



Conclusion.. While the largest categories for both male and female are None, the secondary reason for both was Personal Preference for why they don't eat atleast one type of meat.

In [8]:
```
# Visualization of Pet Ownership vs. Type of Meat Consumption
pet_vs_type_meat = pd.crosstab(df["Pet"], df["TypeMeat"])
print(pet_vs_type_meat)
print(pet_vs_type_meat.plot(kind='bar', figsize = (25,25)))
```

```
TypeMeat  None  Poultry  Poultry, Seafood  Red Meat  Red Meat, Poultry  \
Pet
No          11        9                 6         1                  2
Yes          3        0                 2         2                  2

TypeMeat  Red Meat, Poultry, Seafood  Red Meat, Seafood  Seafood
Pet
No                                34                  2        3
Yes                               33                  0        0
AxesSubplot(0.125,0.125;0.775x0.755)
```

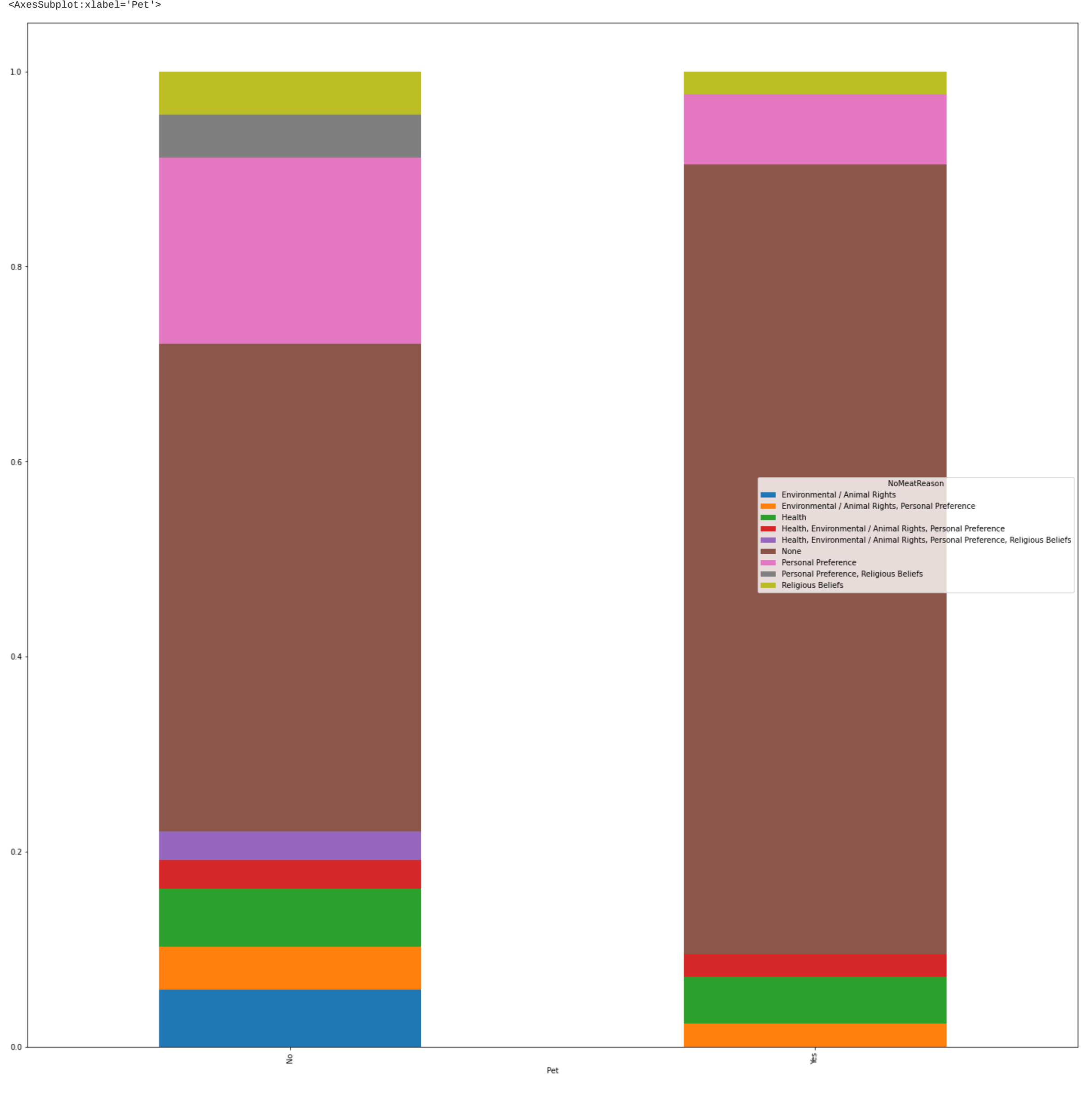


Conclusion... Regardless of Pet Ownership, it appears that the largest category is eating all types of meat; even the counts of people who eat all types of meat are equal. However, of the people that don't own atleast one pet, there is a greater diversity in terms of the combinations of meat that people eat.

In [9]:
```
# Visualization of Given Pet Distribution, distribution of NoMeatReason?
contTable = pd.crosstab(df["Pet"], df["NoMeatReason"])
TypeMeat_counts = contTable.sum(axis = 1)
NumPets_given_TypeMeat = contTable.divide(TypeMeat_counts, axis=0)
print(NumPets_given_TypeMeat)
NumPets_given_TypeMeat.plot.bar(stacked=True, figsize = (25,25))
```

```
NoMeatReason  Environmental / Animal Rights  \
Pet
No                                 0.058824
Yes                                0.000000

NoMeatReason  Environmental / Animal Rights, Personal Preference    Health  \
Pet
No                                                   0.044118  0.058824
Yes                                                  0.023810  0.047619

NoMeatReason  Health, Environmental / Animal Rights, Personal Preference  \
Pet
No                                                   0.029412
Yes                                                  0.023810

NoMeatReason  Health, Environmental / Animal Rights, Personal Preference, Religious Beliefs  \
Pet
No                                                   0.029412
Yes                                                  0.000000

NoMeatReason      None  Personal Preference  \
Pet
No            0.500000             0.191176
Yes           0.809524             0.071429

NoMeatReason  Personal Preference, Religious Beliefs  Religious Beliefs
Pet
No                                          0.044118           0.044118
Yes                                         0.000000           0.023810
```

Out[9]: <AxesSubplot:xlabel='Pet'>

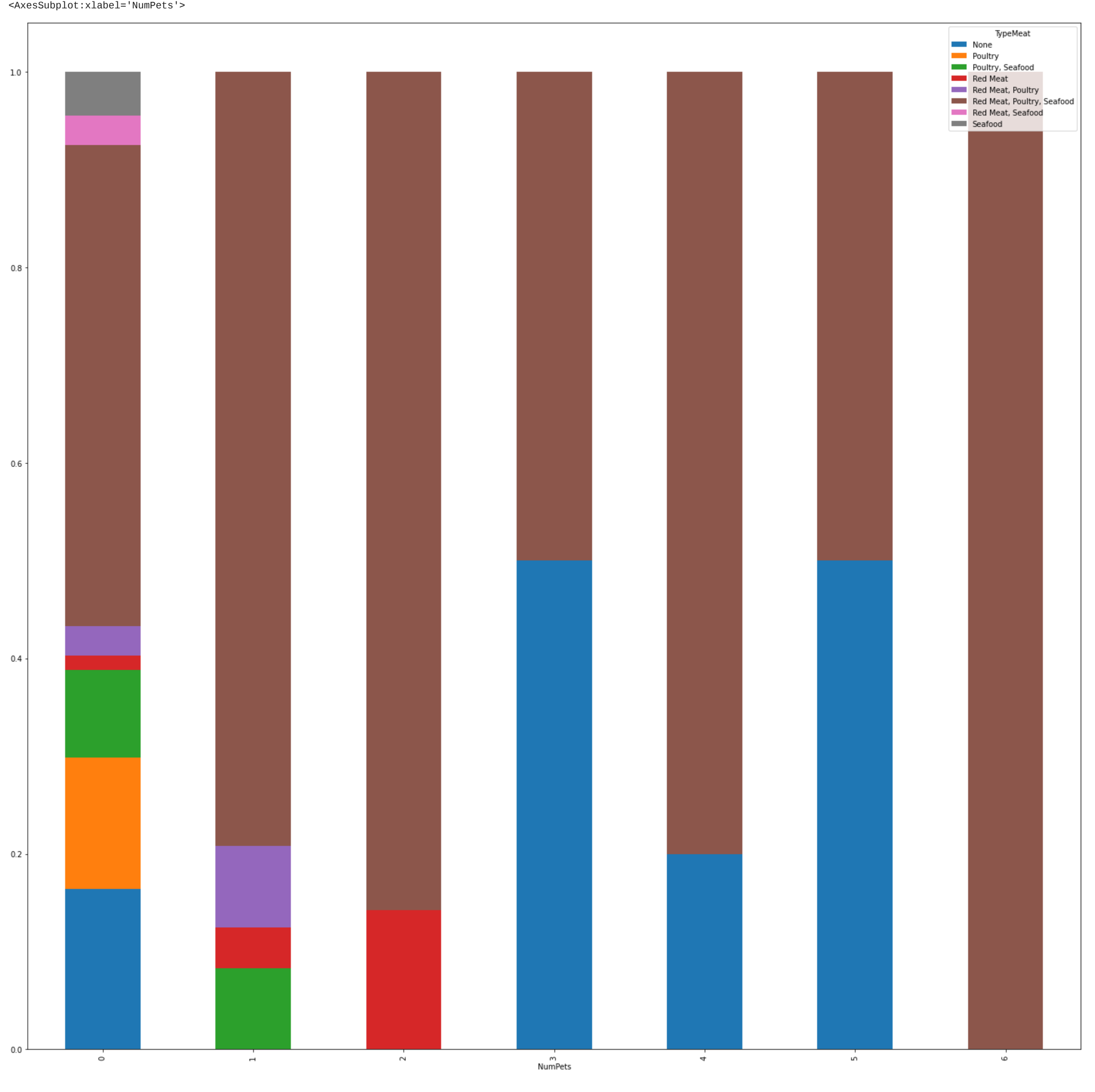


Conclusion.. Regardless of Pet ownership, the largest category was None. However, of the non-pet owners, Personal Preference was the second largest reason by far for why they didn't eat atleast one type of meat.

In [10]:
```
# Visualization Given NumPets, distribution of meat eaten? Anand Mahadevan
contTable = pd.crosstab(df["NumPets"], df["TypeMeat"])
TypeMeat_counts = contTable.sum(axis = 1)
NumPets_given_TypeMeat = contTable.divide(TypeMeat_counts, axis=0)
print(NumPets_given_TypeMeat)
NumPets_given_TypeMeat.plot.bar(stacked=True, figsize = (25,25))
```

```
TypeMeat      None   Poultry  Poultry, Seafood  Red Meat  Red Meat, Poultry  \
NumPets
0         0.164179  0.134328          0.089552  0.014925           0.029851
1         0.000000  0.000000          0.083333  0.041667           0.083333
2         0.000000  0.000000          0.000000  0.142857           0.000000
3         0.500000  0.000000          0.000000  0.000000           0.000000
4         0.200000  0.000000          0.000000  0.000000           0.000000
5         0.500000  0.000000          0.000000  0.000000           0.000000
6         0.000000  0.000000          0.000000  0.000000           0.000000

TypeMeat  Red Meat, Poultry, Seafood  Red Meat, Seafood   Seafood
NumPets
0                           0.492537           0.029851  0.044776
1                           0.791667           0.000000  0.000000
2                           0.857143           0.000000  0.000000
3                           0.500000           0.000000  0.000000
4                           0.800000           0.000000  0.000000
5                           0.500000           0.000000  0.000000
6                           1.000000           0.000000  0.000000
```

Out[10]: <AxesSubplot:xlabel='NumPets'>



Conclusion.. Of all of the categories of NumPets, eating all types of meat was the largest % or 50% in the case for NumPets 3 and 5. The most diversity of types of meat combinations is in NumPets == 0.

TESTS START HERE

Chi_Test by hand using this mock data - Anand Mahadevan

- H0: Pet Ownership and the Type of Meat(s) eaten are independent.
- Ha: Pet Ownership and the Type of Meat(s) eaten are correlated.
- Significance Leve: 0.05
- Pet row, Type Meat Column
- Poultry Poultry,Red Meat None Total
- Yes Pet 10 15 7 32
- No Pet 3 8 10 21
- Total 13 23 17 53
- Total num. people = 53

- Expected Matrix = [7.8491, 13.887, 10.264; 5.1509, 9.1132, 6.7358]

- $X^2 = (10 - 7.8491)^2/7.8491 + (15 - 13.887)^2/13.887 + (7-10.264)^2/10.264 + (3-5.1509)^2/5.1509 + (8-9.1132)^2/9.1132 + (10-6.7358)^2/6.7358 = 4.332692776$

- Degrees of Freedom: (2-1)(3-1) = 2
- p-value = 0.1146

- So, in conclusion, with a significance level of 0.05, there is insufficient evidence to reject H0. Pet Ownership and the Type of Meat(s) eaten are independent.

In [11]:
```
#Chi-Square Pet Yes No vs. Meat Type
pet_and_meat = pd.crosstab(df["Pet"], df["TypeMeat"])
chi2_contingency(pet_and_meat)
# in order: X^2, p-value, degrees of freedom, expected value matrix
```

Out[11]:
```
(15.648478296791355,
 0.02852929056853062,
 7,
 array([[ 8.65454545,  5.56363636,  4.94545455,  1.85454545,  2.47272727,
         41.41818182,  1.23636364,  1.85454545],
        [ 5.34545455,  3.43636364,  3.05454545,  1.14545455,  1.52727273,
         25.58181818,  0.76363636,  1.14545455]]))
```

Conclusion...

- Prediction: Based on the visualization of Pet and TypeMeat above, I predict my null hypothesis to be rejected as there are a lot of categories in the no pet column of meat that aren't being represented in the yes meat column.
- H0: Pet Ownership and the Type of Meat(s) eaten are independent.
- Ha: Pet Ownership and the Type of Meat(s) eaten are correlated.
- Significance Level: 0.05
- So, in conclusion, with a significance level of 0.05, there is sufficient evidence to reject H0. Pet Ownership and the Type of Meat(s) eaten are correlated.

One-Sample t-test by hand using this mock data - Arzhang

- H0: The mean number of pets owned by people is 0.5.
- HA: The mean number of pets owned by people is not 0.5.
- pet data: [0,2,1,3,0,4,0,1]
- t = (mean - pop. mean) / (std. dev. / sqrt(n))
- t = (1.375 - 0.5) / (1.506/sqrt(8)) = 1.6434
- Degrees of Freedom = n - 1 = 7
- p = 0.144
- So, in conclusion, with a significance level of 0.05, there is insufficient evidence to reject H0. The mean number of pets owned by people is 0.5.

In [12]:
```
#One-Sample t-test for NumPets
from scipy import stats
num_of_pets  = df["NumPets"]
stats.ttest_1samp(num_of_pets, popmean=0.5)
```

Out[12]: Ttest_1sampResult(statistic=2.423044399336984, pvalue=0.017038294140848544)

Conclusion...

- Prediction: Based on the visualization of NumPets above, I predict my null hypothesis to be rejected because of the large amount of people in the 0 category.
- H0: The mean number of pets owned by people is 0.5.
- HA: The mean number of pets owned by people is not 0.5.
- Significance Level: 0.05
- So, in conclusion, with a significance level of 0.05, there is sufficient evidence to reject H0. The true mean of pets owned is not 0.5.

Binomial Test by hand using this mock data - Aaron

- No more than 10% of pet owners don't eat meat
- n = number of trials
- k = number of successes
- p = probability of success for a single trial

- formula: $P(B=k) = (n!/(k!(n-k)!) * p^k (1-p)^(n-k)$

- H0: No more than 10% of pet owners are non-meat consumers.

- HA: More than 10% of pet owners are non-meat consumers.

- Out of 88 pet owners we found that 11 of them did not eat meat.

- n = 88
- k = 11
- p = 0.1

- $P(B=k) = (88!/(11!(88-11)!) * 0.1^11 (1-0.1)^(88-11)$

- = 0.095
- this is the the probaility for exactly 11 out of 88 people
- The probability of exactly, or more than, 11 out of 88 people is 0.263

- So we fail to reject the null hypothesis. No more than 10% of pet owners are non-meat consumers.

In [13]:
```
#binomial test
#no more than 10% of pet owners don't eat meat
from scipy.stats import binom_test
df['Meat'] = 0
df.loc[(df['TypeMeat'] == 'Poultry') | (df['TypeMeat'] == 'Red Meat')| (df['TypeMeat'] == 'Seafood')| (df['TypeMeat'] == 'Poultry, Seafood')| (df['TypeMeat'] == 'Red Meat, Poultry, Seafood')| (df['TypeMeat'] == 'Red Meat, Poultry
display(df.groupby("Pet")['Meat'].value_counts())
binom_test(x = 3, n = 42, p = 0.1, alternative='greater')
```

```
Pet  Meat
No   1       57
     0       11
Yes  1       39
     0        3
Name: Meat, dtype: int64
```

Out[13]: 0.8048923451730632

Conclusion...

- Prediction: I predict that there will be not enough evidence to reject the null hypothesis because 10% of 39 is very close to 3.
- H0: No more than 10% of pet owners are non-meat consumers.
- HA: More than 10% of pet owners are non-meat consumers.
- So, in conclusion, with a significance level of 0.05, there is not sufficient evidence to reject H0. No more than 10% of pet owners are non-meat consumers.