```
# Latihan 1
# Import library numpy untuk operasi fungsi aritmatika
import numpy as np

# import library pandas untuk operasi dataframe
import pandas as pd

# Import library matplotlib dan seaborn untuk visualisasi
import matplotlib
import matplotlib.pyplot as plt
from matplotlib import colors
import seaborn as sns

# Import library Axes3D untuk vizualisasi 3 Dimensi
from mpl_toolkits.mplot3d import Axes3D

# import library datetime untuk operasi yang berhubungan dengan waktu.
import datetime

# import library Label encoder untuk mengubah setiap nilai dalam kolom
menjadi angka yang berurutan / numeric
from sklearn.preprocessing import LabelEncoder

# import library StandardScaler untuk menskalakan nilai kolom jika
terdpaat perbedaan skala, StandardScaler berfungsi menghilangkan mean
(terpusat pada 0) dan menskalakan ke variansi (deviasi standar = 1),
dengan asumsi data terdistribusi normal (gauss) untuk semua fitur
from sklearn.preprocessing import StandardScaler

# import library PCA adalah prosedur statistik yang mengekstrak fitur-
fitur terpenting dari suatu dataset
from sklearn.decomposition import PCA

# import library KElbowVisualizer untuk mengimplementasikan metode
"elbow/siku" untuk data scientist memilih jumlah cluster yang optimal
dengan menyesuaikan model dengan rentang nilai untuk K
from yellowbrick.cluster import KElbowVisualizer

# import library KMeans metode adalah teknik unsupervised machine
learning yang digunakan untuk mengidentifikasi kelompok objek data
dalam kumpulan data
from sklearn.cluster import KMeans

# import library AgglomerativeClustering untuk melakukan pengelompokan
data menggunakan bottom-up manner
from sklearn.cluster import AgglomerativeClustering


# import library metrics untuk mengimplementasikan fungsi yang menilai
```

```
kesalahan prediksi untuk tujuan tertentu
from sklearn import metrics

# me-non aktifkan peringatan pada python
import warnings
import sys
if not sys.warnoptions:
    warnings.simplefilter("ignore")

# mendefinisikan nilai acak
np.random.seed(42)

# Latihan 2
#Load the dataset dan tampilkan data nya
data = pd.read_csv('marketing_campaign.csv', sep="\t")
print("Number of datapoints:", len(data))
data.head()
```

```
Number of datapoints: 2240
```

```
     ID  Year_Birth   Education  ... Z_CostContact  Z_Revenue
Response
0  5524        1957  Graduation  ...             3         11
1
1  2174        1954  Graduation  ...             3         11
0
2  4141        1965  Graduation  ...             3         11
0
3  6182        1984  Graduation  ...             3         11
0
4  5324        1981         PhD  ...             3         11
0

[5 rows x 29 columns]
```

```
# Latihan 3
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2240 entries, 0 to 2239
Data columns (total 29 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   ID                   2240 non-null   int64
 1   Year_Birth           2240 non-null   int64
 2   Education            2240 non-null   object
 3   Marital_Status       2240 non-null   object
 4   Income               2216 non-null   float64
 5   Kidhome              2240 non-null   int64
 6   Teenhome             2240 non-null   int64
 7   Dt_Customer          2240 non-null   object
```

```
 8   Recency              2240 non-null   int64
 9   MntWines             2240 non-null   int64
 10  MntFruits            2240 non-null   int64
 11  MntMeatProducts      2240 non-null   int64
 12  MntFishProducts      2240 non-null   int64
 13  MntSweetProducts     2240 non-null   int64
 14  MntGoldProds         2240 non-null   int64
 15  NumDealsPurchases    2240 non-null   int64
 16  NumWebPurchases      2240 non-null   int64
 17  NumCatalogPurchases  2240 non-null   int64
 18  NumStorePurchases    2240 non-null   int64
 19  NumWebVisitsMonth    2240 non-null   int64
 20  AcceptedCmp3         2240 non-null   int64
 21  AcceptedCmp4         2240 non-null   int64
 22  AcceptedCmp5         2240 non-null   int64
 23  AcceptedCmp1         2240 non-null   int64
 24  AcceptedCmp2         2240 non-null   int64
 25  Complain             2240 non-null   int64
 26  Z_CostContact        2240 non-null   int64
 27  Z_Revenue            2240 non-null   int64
 28  Response             2240 non-null   int64
dtypes: float64(1), int64(25), object(3)
memory usage: 507.6+ KB
```

```
# menghapus missing values
data = data.dropna()
print("Jumlah data setelah menghapus baris dengan nilai yang hilang
adalah:", len(data))
```

```
Jumlah data setelah menghapus baris dengan nilai yang hilang adalah:
2216
```

```
data["Dt_Customer"] = pd.to_datetime(data["Dt_Customer"])
dates = []
for i in data["Dt_Customer"]:
    i = i.date()
    dates.append(i)

# Tanggal pelanggan terbaru dan terlama yang tercatat
print("Tanggal pendaftaran pelanggan terbaru dalam
catatan:",max(dates))
print("Tanggal pendaftaran pelanggan terlama dalam
catatan:",min(dates))
```

```
Tanggal pendaftaran pelanggan terbaru dalam catatan: 2014-12-06
Tanggal pendaftaran pelanggan terlama dalam catatan: 2012-01-08
```

```
# Membuat fitur "Customer_For"
days = []
d1 = max(dates) # membawanya menjadi pelanggan terbaru
for i in dates:
```

```
    delta = d1 - i
    days.append(delta)
data["Customer_For"] = days
data["Customer_For"] = pd.to_numeric(data["Customer_For"],
errors="coerce")

print("Total kategori dalam fitur Marital_Status:\n\n",
data["Marital_Status"].value_counts(), "\n")
print("Total kategori dalam fitur Education:\n\n",
data["Education"].value_counts())
```

```
Total kategori dalam fitur Marital_Status:

 Married     857
Together    573
Single      471
Divorced    232
Widow        76
Alone         3
YOLO          2
Absurd        2
Name: Marital_Status, dtype: int64

Total kategori dalam fitur Education:

 Graduation    1116
PhD             481
Master          365
2n Cycle        200
Basic            54
Name: Education, dtype: int64
```

```
# Latihan 4
#Feature Engineering

# Usia pelanggan hari ini
data["Age"] = 2021-data["Year_Birth"]

# Total pengeluaran untuk berbagai macam item
data["Spent"] = data["MntWines"]+ data["MntFruits"]+
data["MntMeatProducts"]+ data["MntFishProducts"]+
data["MntSweetProducts"]+ data["MntGoldProds"]

# situasi kehidupan dari status pernikahan "Alone"
data["Living_With"]=data["Marital_Status"].replace({"Married":"Partner
", "Together":"Partner", "Absurd":"Alone", "Widow":"Alone",
"YOLO":"Alone", "Divorced":"Alone", "Single":"Alone",})

# Fitur yang menunjukkan jumlah anak yang tinggal di rumah tangga
data["Children"]=data["Kidhome"]+data["Teenhome"]
```

```
# Fitur untuk total anggota dalam rumah tangga
data["Family_Size"] = data["Living_With"].replace({"Alone": 1,
"Partner":2})+ data["Children"]

# Fitur yang berkaitan dengan orang tua
data["Is_Parent"] = np.where(data.Children> 0, 1, 0)

# Segmentasi tingkat pendidikan dalam tiga kelompok
data["Education"]=data["Education"].replace({"Basic":"Undergraduate","
2n Cycle":"Undergraduate", "Graduation":"Graduate",
"Master":"Postgraduate", "PhD":"Postgraduate"})

# Untuk kejelasan produk
data=data.rename(columns={"MntWines":
"Wines","MntFruits":"Fruits","MntMeatProducts":"Meat","MntFishProducts
":"Fish","MntSweetProducts":"Sweets","MntGoldProds":"Gold"})


# Drop / Menjatuhkan beberapa fitur yang berlebihan / redundant
features
to_drop = ["Marital_Status", "Dt_Customer", "Z_CostContact",
"Z_Revenue", "Year_Birth", "ID"]
data = data.drop(to_drop, axis=1)

# melihat statistik data untuk data numeric
data.describe()
```

```
              Income      Kidhome  ...  Family_Size    Is_Parent
count    2216.000000  2216.000000  ...  2216.000000  2216.000000
mean    52247.251354     0.441787  ...     2.592509     0.714350
std     25173.076661     0.536896  ...     0.905722     0.451825
min      1730.000000     0.000000  ...     1.000000     0.000000
25%     35303.000000     0.000000  ...     2.000000     0.000000
50%     51381.500000     0.000000  ...     3.000000     1.000000
75%     68522.000000     1.000000  ...     3.000000     1.000000
max    666666.000000     2.000000  ...     5.000000     1.000000

[8 rows x 28 columns]
```

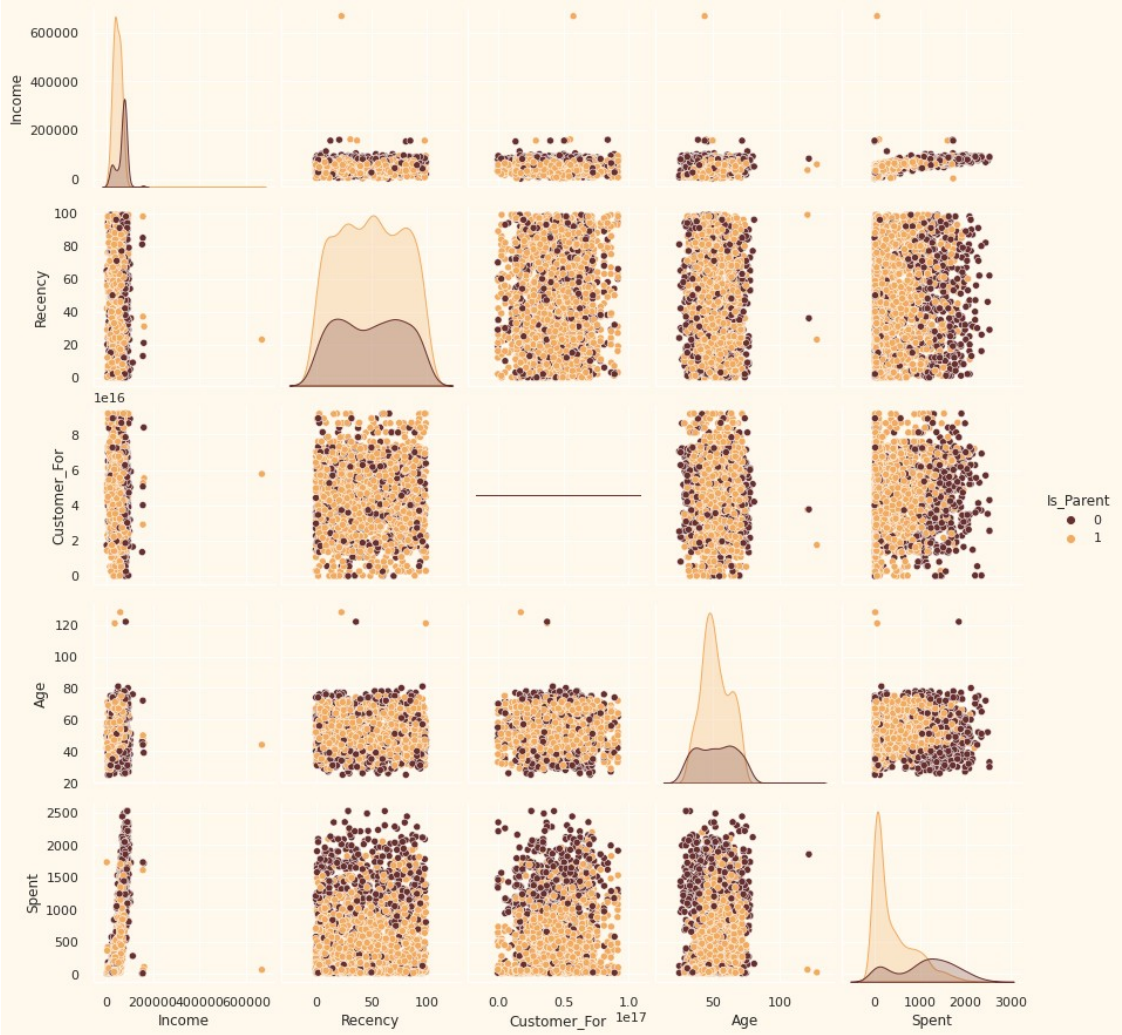
```
# Latihan 5
#To plot some selected features
#Setting up colors prefrences
sns.set(rc={"axes.facecolor":"#FFF9ED","figure.facecolor":"#FFF9ED"})
pallet = ["#682F2F", "#9E726F", "#D6B2B1", "#B9C0C9", "#9F8A78",
"#F3AB60"]
cmap = colors.ListedColormap(["#682F2F", "#9E726F", "#D6B2B1",
"#B9C0C9", "#9F8A78", "#F3AB60"])
```

```
#Plotting fitur
To_Plot = [ "Income", "Recency", "Customer_For", "Age", "Spent",
"Is_Parent"]
print("Plot Relatif Dari Beberapa Fitur Terpilih: Subset Data")
plt.figure()
sns.pairplot(data[To_Plot], hue= "Is_Parent",palette=
(["#682F2F","#F3AB60"]))

plt.show()
```

```
Plot Relatif Dari Beberapa Fitur Terpilih: Subset Data

<Figure size 432x288 with 0 Axes>
```

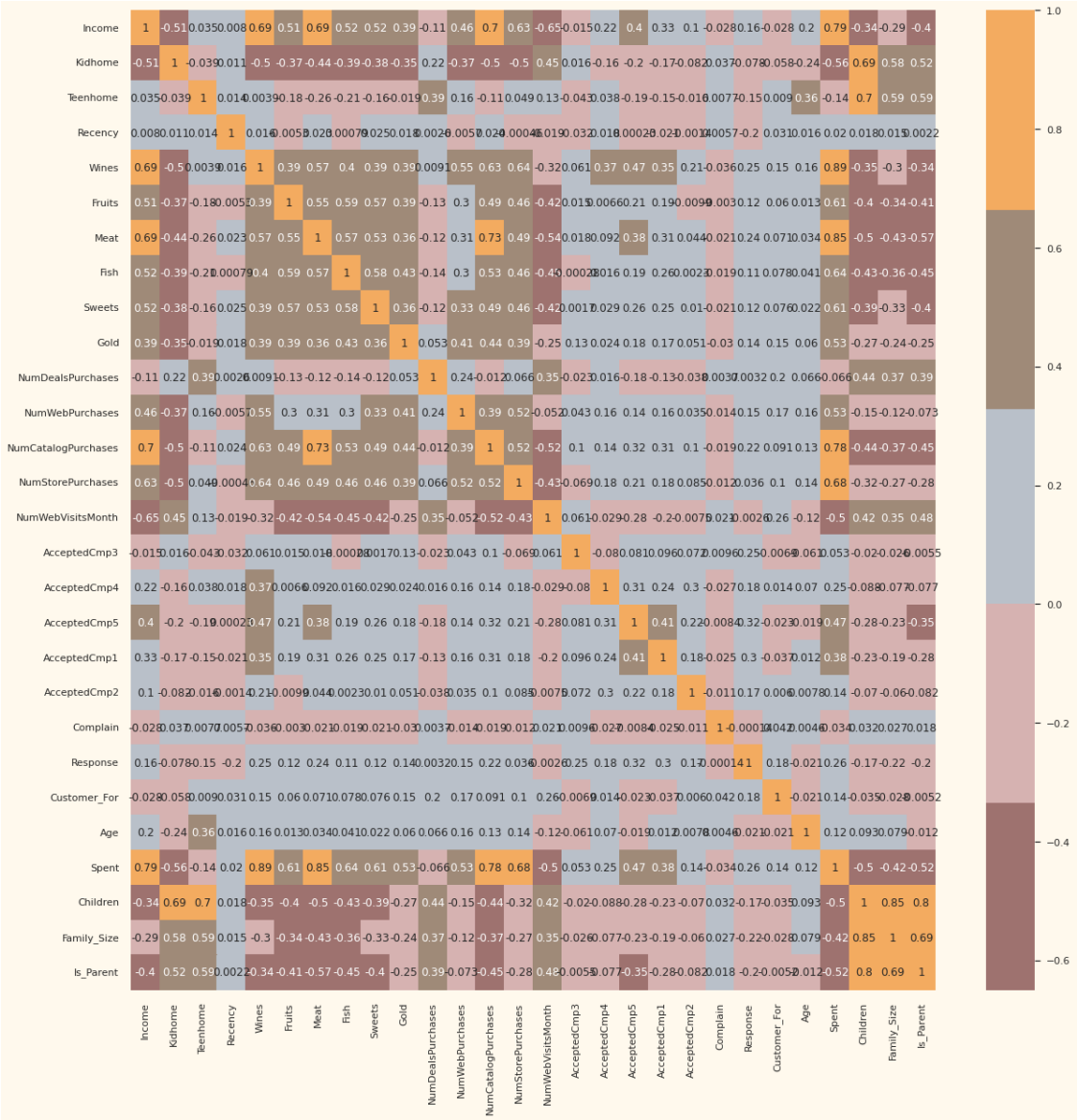



```
# Drop outlier dengan menetapkan batas pada Usia dan pendapatan.
data = data[(data["Age"]<90)]
data = data[(data["Income"]<600000)]
print("Jumlah total data setelah menghapus outlier adalah:",
len(data))
```

```
Jumlah total data setelah menghapus outlier adalah: 2212
```

```
#correlation matrix
corrmat= data.corr()
plt.figure(figsize=(20,20))
sns.heatmap(corrmat,annot=True, cmap=cmap, center=0)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7effeb904510>
```




```
# Latihan 6
# Get List dari variabel categorical
s = (data.dtypes == 'object')
object_cols = list(s[s].index)
```

```
print("Variabel kategori dalam dataset:", object_cols)
```

```
Variabel kategori dalam dataset: ['Education', 'Living_With']
```

```
# Label Encoding (dtypes: objek)
LE=LabelEncoder()
for i in object_cols:
    data[i]=data[[i]].apply(LE.fit_transform)

print("Semua fitur sekarang numerik")
```

```
Semua fitur sekarang numerik
```

```
# Membuat salinan data
ds = data.copy()

# membuat subset dataframe dengan menghapus fitur pada penawaran yang
diterima (features on deals accepted) dan promosi (promotions)
cols_del = ['AcceptedCmp3', 'AcceptedCmp4', 'AcceptedCmp5',
'AcceptedCmp1','AcceptedCmp2', 'Complain', 'Response']
ds = ds.drop(cols_del, axis=1)

#Scaling
scaler = StandardScaler()
scaler.fit(ds)
scaled_ds = pd.DataFrame(scaler.transform(ds),columns= ds.columns )
print("Semua fitur sekarang sudah diskalakan")
```

```
Semua fitur sekarang sudah diskalakan
```

```
# Data yang diskalakan untuk digunakan untuk mengurangi
dimensi/reducing the dimensionality
print("Dataframe yang akan digunakan untuk pemodelan lebih lanjut:")
scaled_ds.head()
```

```
Dataframe yang akan digunakan untuk pemodelan lebih lanjut:

   Education    Income   Kidhome  ...  Children  Family_Size
Is_Parent
0  -0.893586  0.287105 -0.822754  ... -1.264598    -1.758359  -
1.581139
1  -0.893586 -0.260882  1.040021  ...  1.404572     0.449070
0.632456
2  -0.893586  0.913196 -0.822754  ... -1.264598    -0.654644  -
1.581139
3  -0.893586 -1.176114  1.040021  ...  0.069987     0.449070
0.632456
4   0.571657  0.294307  1.040021  ...  0.069987     0.449070
0.632456

[5 rows x 23 columns]
```

```
# Latihan 7
# Memulai PCA untuk mengurangi dimensi alias fitur menjadi 3
```

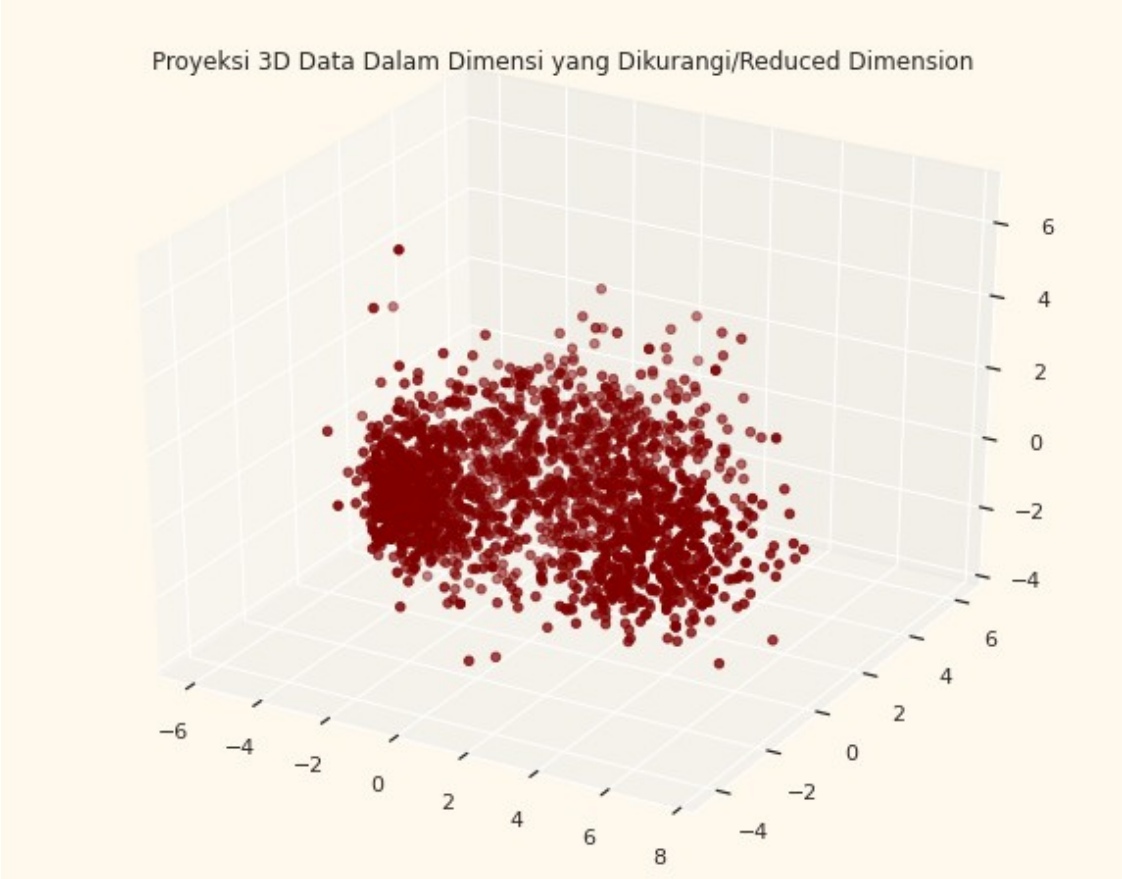
```
pca = PCA(n_components=3)
pca.fit(scaled_ds)
PCA_ds = pd.DataFrame(pca.transform(scaled_ds),
columns=(["col1","col2", "col3"]))
PCA_ds.describe().T
```

```
       count          mean       std  ...       50%       75%
max
col1  2212.0 -8.612761e-17  2.878377  ... -0.780421  2.383290
7.444305
col2  2212.0  2.559737e-17  1.706839  ... -0.158123  1.242289
6.142721
col3  2212.0  4.449425e-17  1.221956  ... -0.022692  0.799895
6.611222

[3 rows x 8 columns]
```

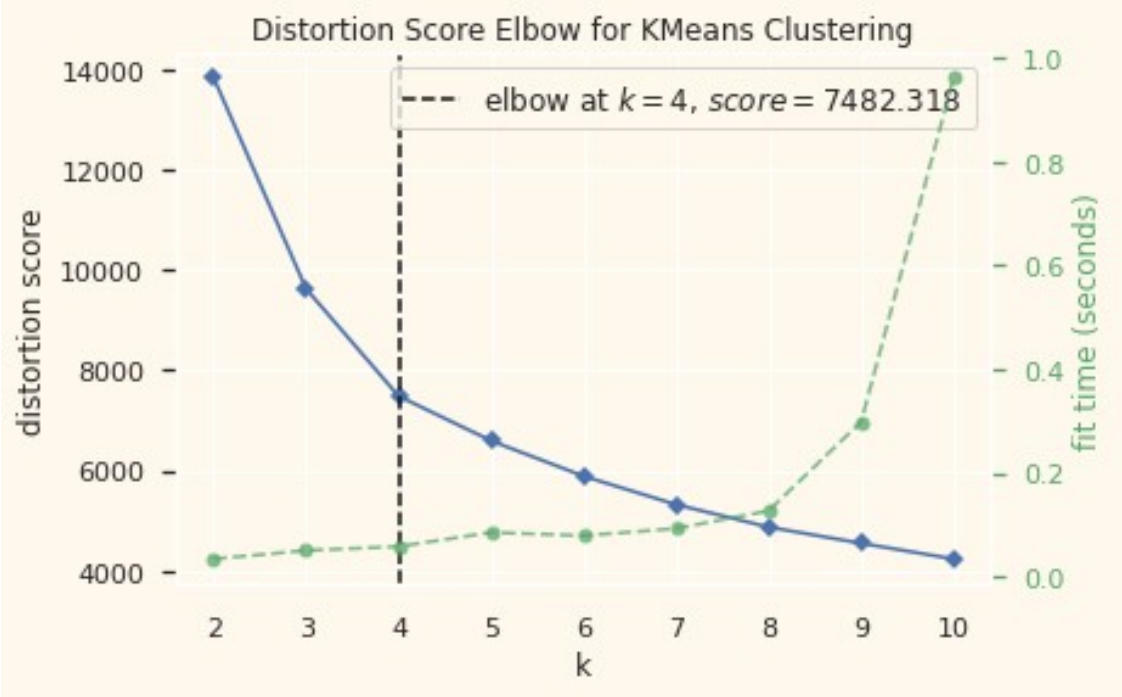
```
# Proyeksi 3D Data Dalam Dimensi yang Dikurangi/Reduced Dimension
x =PCA_ds["col1"]
y =PCA_ds["col2"]
z =PCA_ds["col3"]

# plotting
fig = plt.figure(figsize=(10,8))
ax = fig.add_subplot(111, projection="3d")
ax.scatter(x,y,z, c="maroon", marker="o" )
ax.set_title("Proyeksi 3D Data Dalam Dimensi yang Dikurangi/Reduced
Dimension")
plt.show()
```




```
# Latihan 8
# Quick examination of elbow method to find numbers of clusters to
make.
print('Metode Elbow untuk menentukan jumlah cluster yang akan
dibentuk:')
Elbow_M = KElbowVisualizer(KMeans(), k=10)
Elbow_M.fit(PCA_ds)
Elbow_M.show()
```

```
Metode Elbow untuk menentukan jumlah cluster yang akan dibentuk:
```



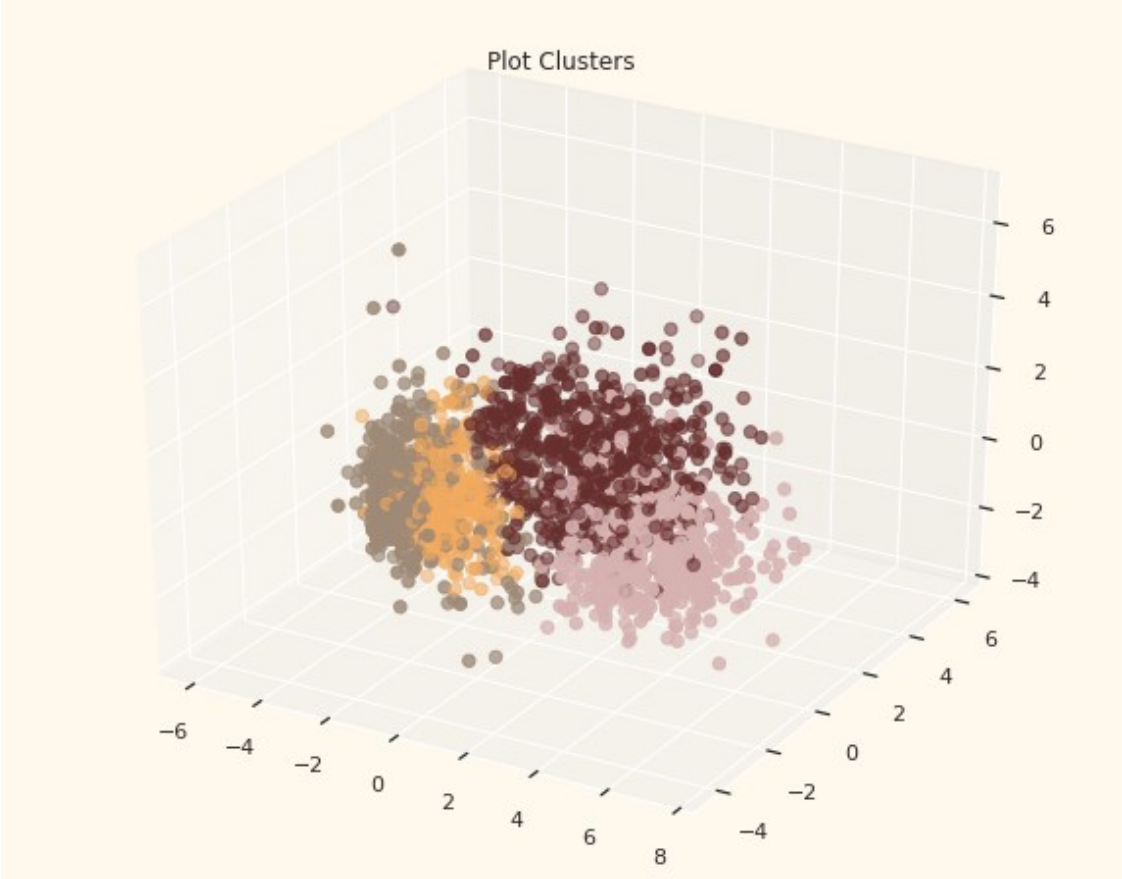

```
<matplotlib.axes._subplots.AxesSubplot at 0x7effeb7a8650>
```

```
# Memulai model Agglomerative Clustering
AC = AgglomerativeClustering(n_clusters=4)

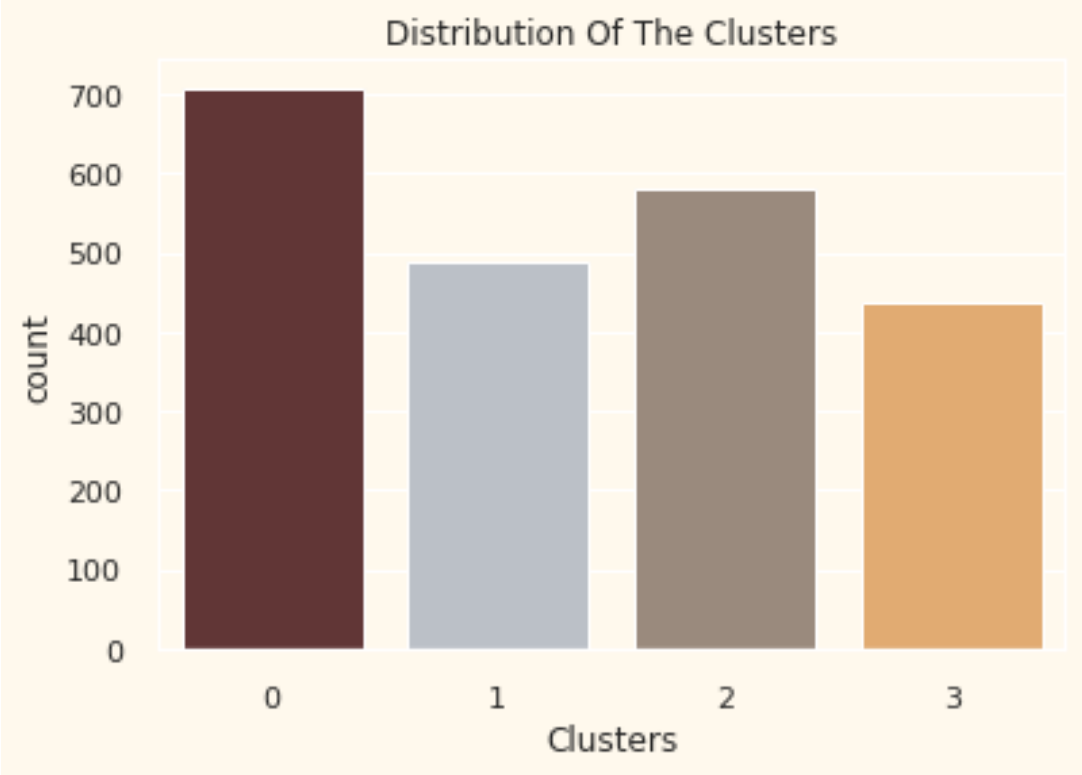
# fit model and predict clusters
yhat_AC = AC.fit_predict(PCA_ds)
PCA_ds["Clusters"] = yhat_AC

# Menambahkan fitur Cluster ke dataframe asli.
data["Clusters"]= yhat_AC

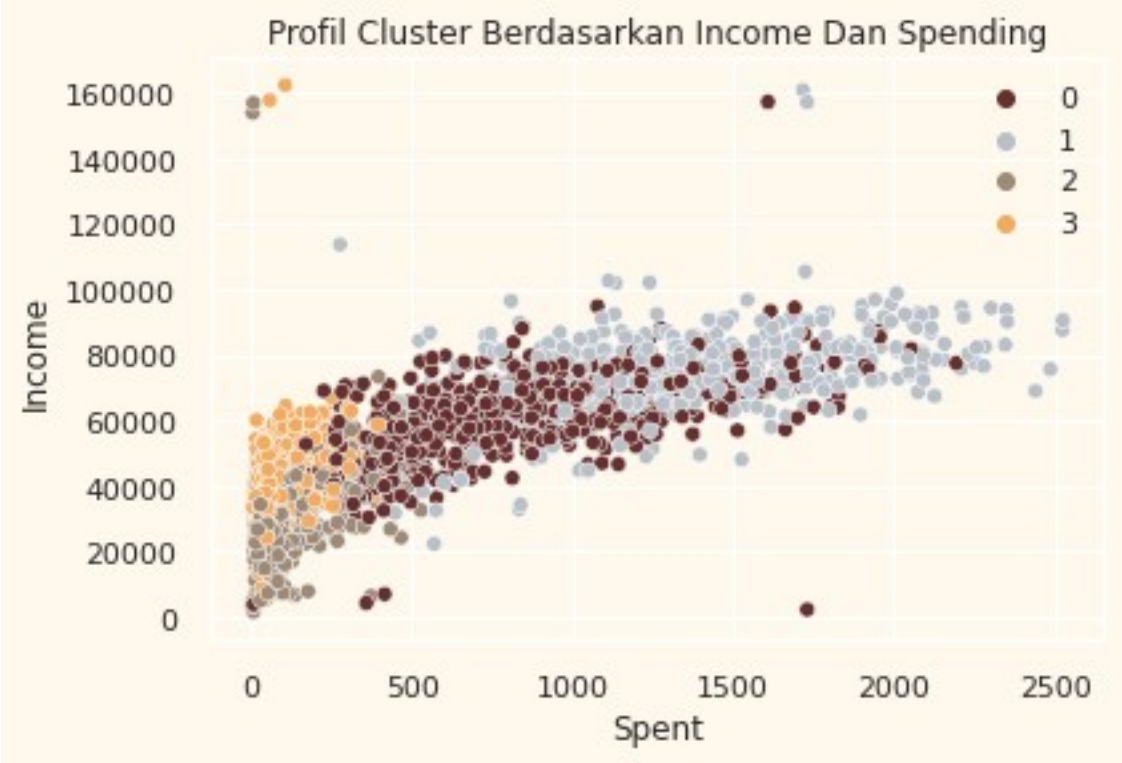
#Plotting clusters
fig = plt.figure(figsize=(10,8))
ax = plt.subplot(111, projection='3d', label="bla")
ax.scatter(x, y, z, s=40, c=PCA_ds["Clusters"], marker='o', cmap =
cmap )
ax.set_title("Plot Clusters")
plt.show()
```




```
# Latihan 9
#Plotting countplot dari clusters
pal = ["#682F2F","#B9C0C9", "#9F8A78","#F3AB60"]
pl = sns.countplot(x=data["Clusters"], palette= pal)
pl.set_title("Distribution Of The Clusters")
plt.show()
```

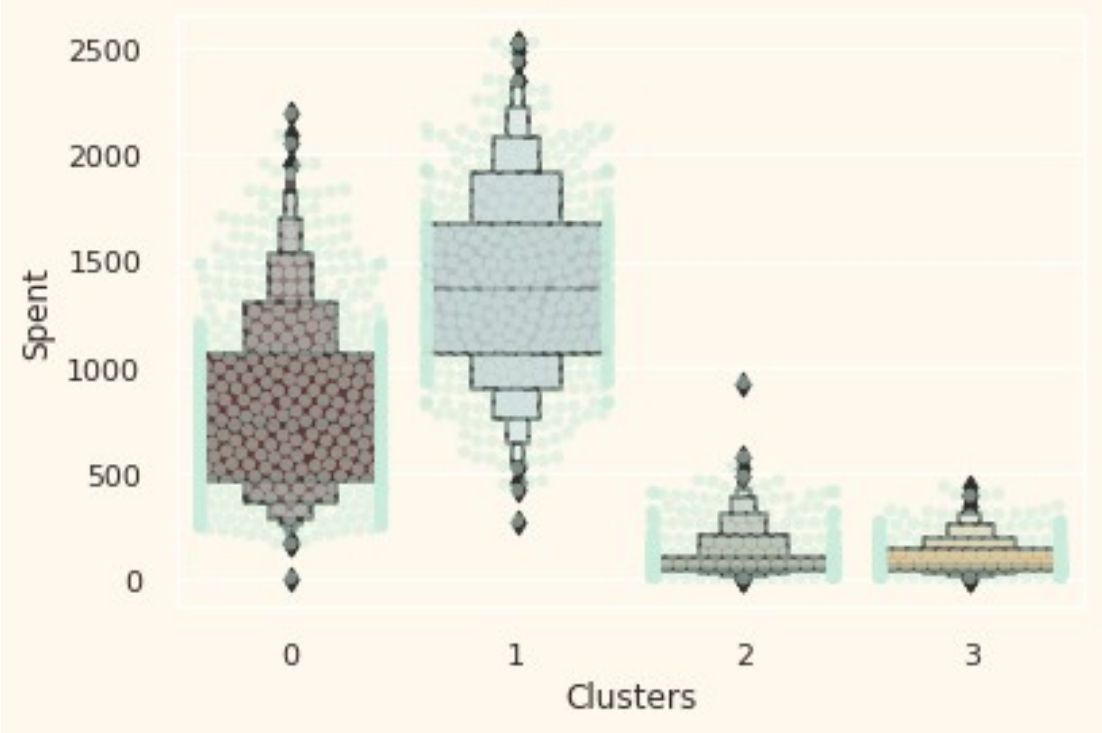



```
pl = sns.scatterplot(data = data,x=data["Spent"],
y=data["Income"],hue=data["Clusters"], palette= pal)
pl.set_title("Profil Cluster Berdasarkan Income Dan Spending")
plt.legend()
plt.show()
```



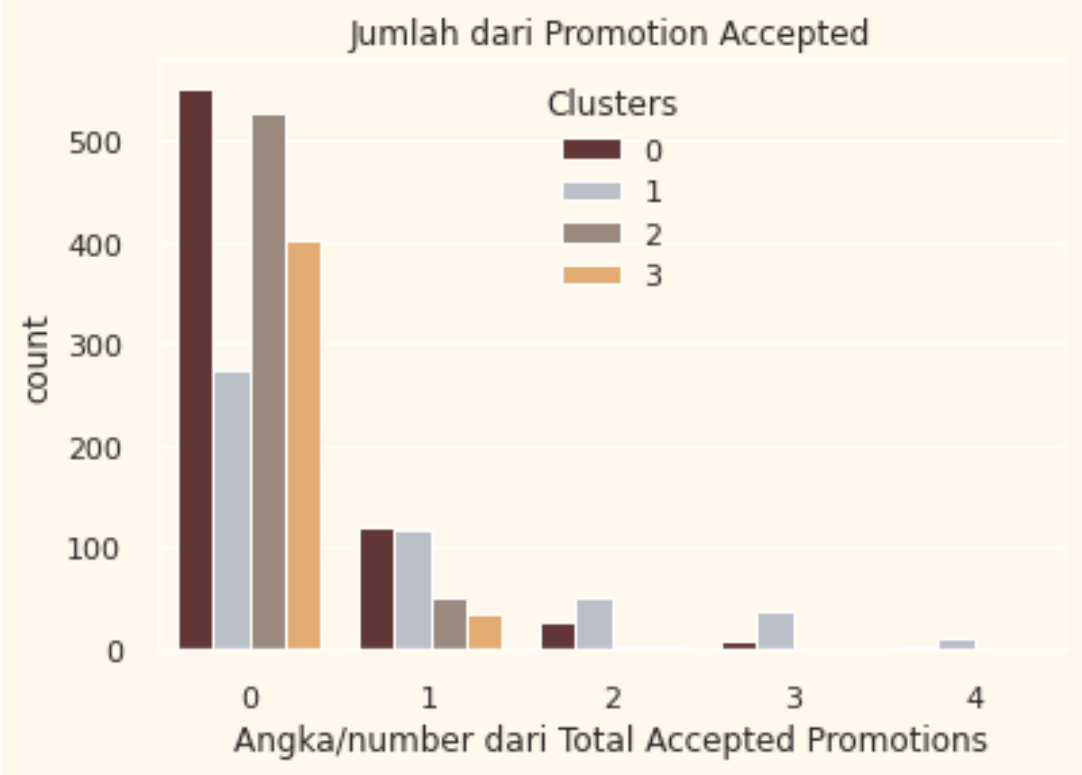

```
plt.figure()
pl=sns.swarmplot(x=data["Clusters"], y=data["Spent"], color=
"#CBEDDD", alpha=0.5 )
pl=sns.boxenplot(x=data["Clusters"], y=data["Spent"], palette=pal)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/categorical.py:1296:
UserWarning: 55.2% of the points cannot be placed; you may want to
decrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
/usr/local/lib/python3.7/dist-packages/seaborn/categorical.py:1296:
UserWarning: 36.3% of the points cannot be placed; you may want to
decrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
/usr/local/lib/python3.7/dist-packages/seaborn/categorical.py:1296:
UserWarning: 83.3% of the points cannot be placed; you may want to
decrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
/usr/local/lib/python3.7/dist-packages/seaborn/categorical.py:1296:
UserWarning: 81.7% of the points cannot be placed; you may want to
decrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
```

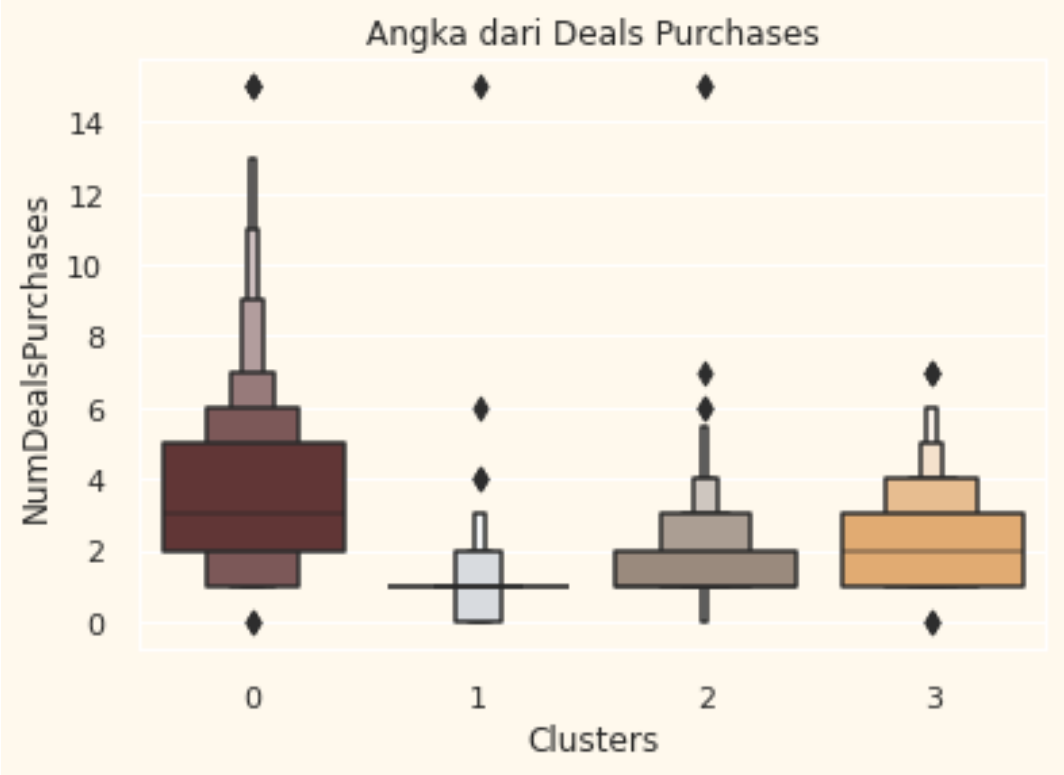



```
# Membuat fitur untuk mendapatkan sejumlah promosi yang
diterima/accepted promotions
data["Total_Promos"] = data["AcceptedCmp1"]+ data["AcceptedCmp2"]+
data["AcceptedCmp3"]+ data["AcceptedCmp4"]+ data["AcceptedCmp5"]

# plotting Jumlah dari total kampanye yang diterima.
plt.figure()
pl = sns.countplot(x=data["Total_Promos"],hue=data["Clusters"],
palette= pal)
pl.set_title("Jumlah dari Promotion Accepted")
pl.set_xlabel("Angka/number dari Total Accepted Promotions")
plt.show()
```



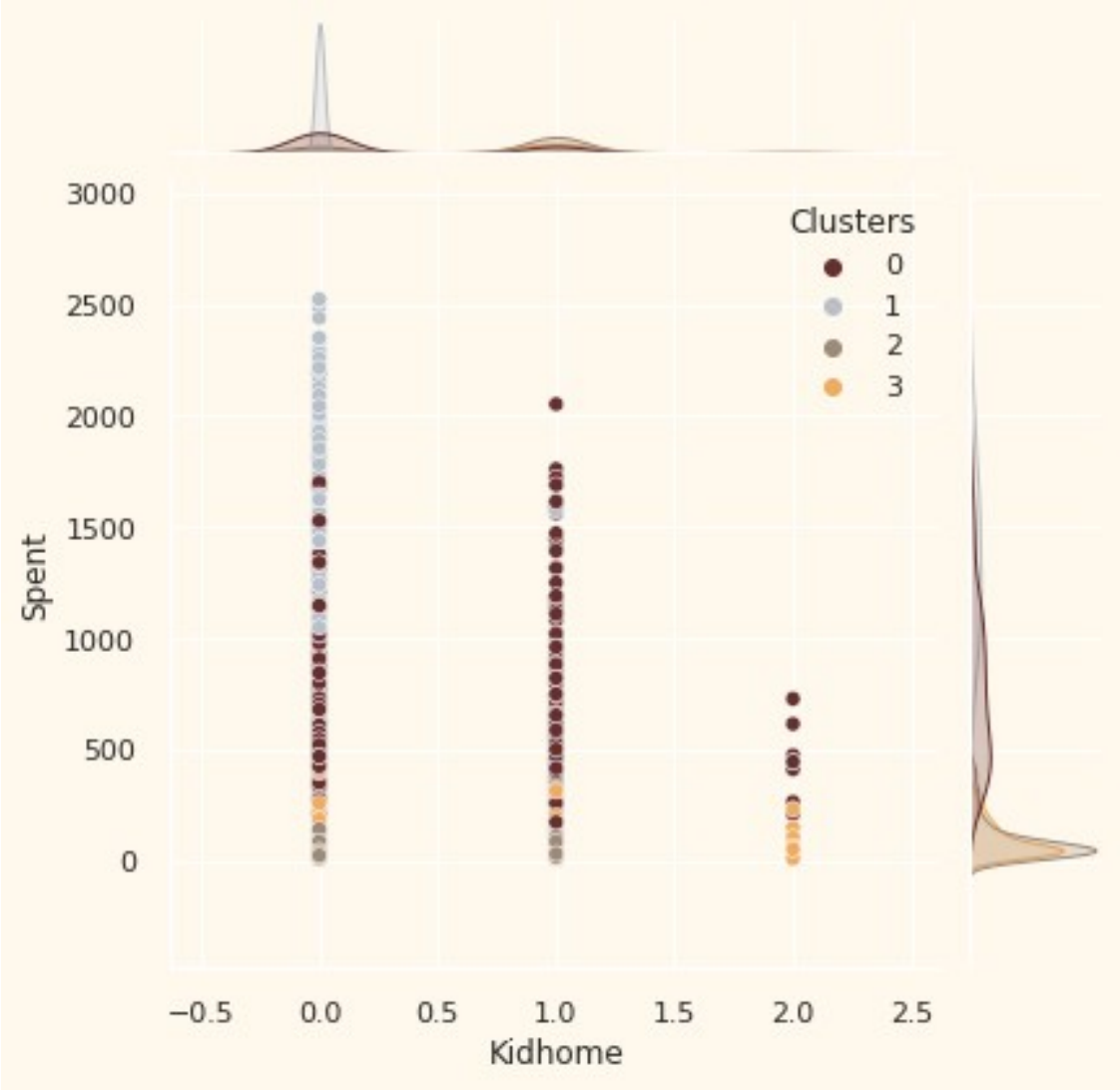

```
#Plotting jumlah transaksi yang dibeli / deals purchased
plt.figure()
pl=sns.boxenplot(y=data["NumDealsPurchases"],x=data["Clusters"],
palette= pal)
pl.set_title("Angka dari Deals Purchases")
plt.show()
```



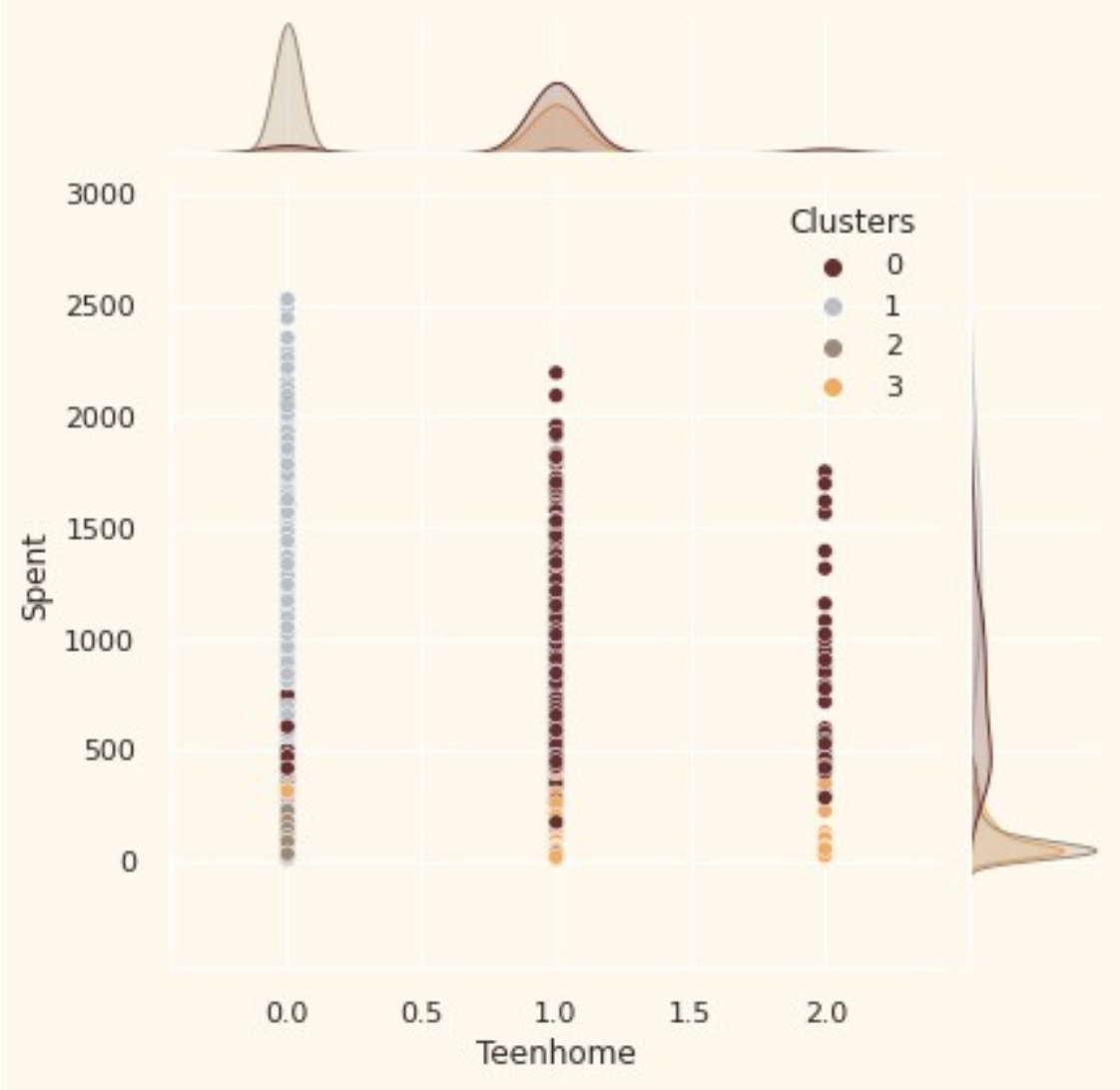

```
# untuk detail lebih lanjut tentang gaya pembelian/purchasing style
Places = [ "Kidhome","Teenhome","Customer_For", "Age", "Children",
"Family_Size", "Is_Parent", "Education","Living_With"]

for i in Places:
    plt.figure()
    sns.jointplot(x=data[i],y = data["Spent"],hue=data["Clusters"],
palette= pal)
    plt.show()
```

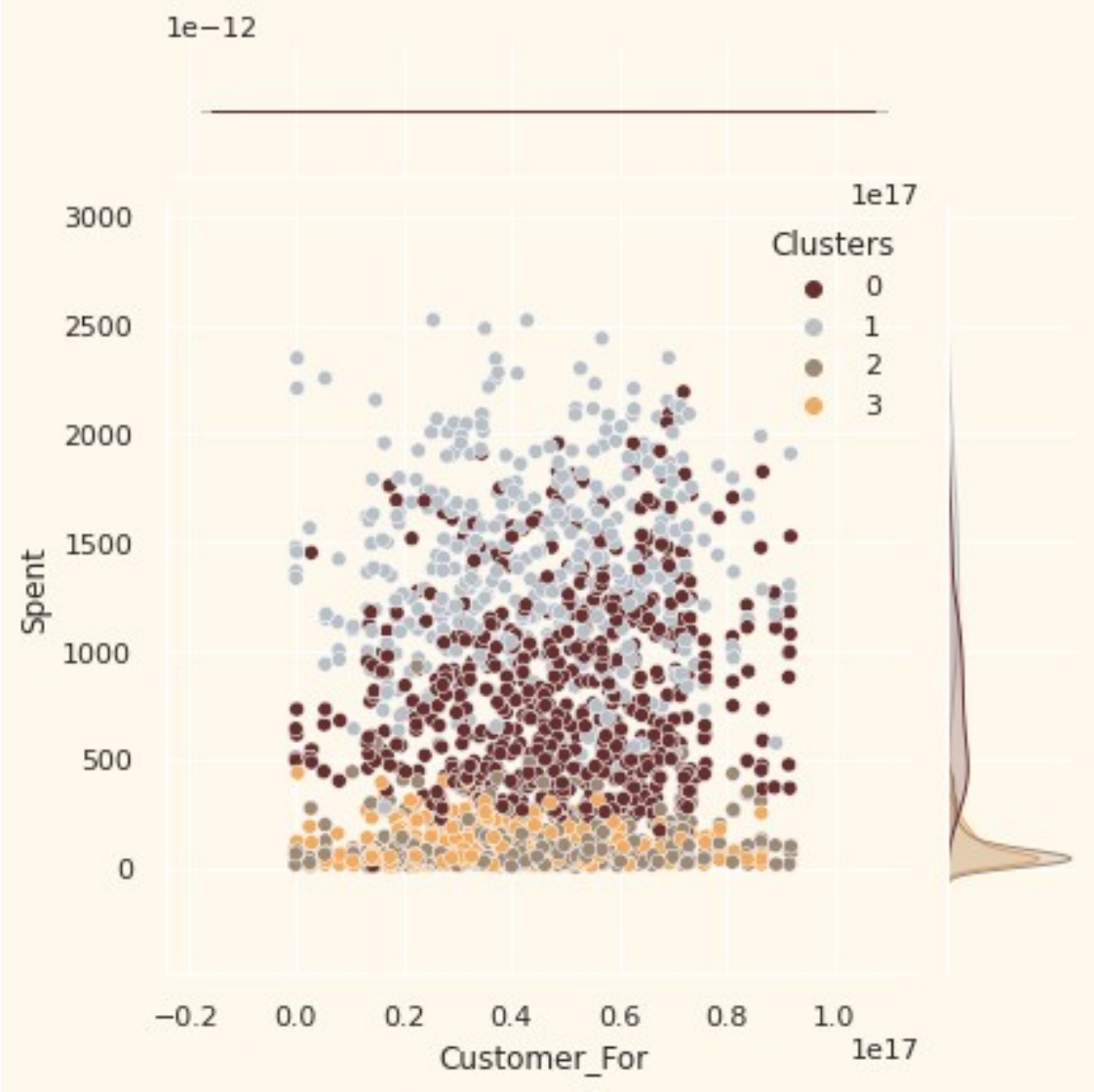
```
<Figure size 432x288 with 0 Axes>
```



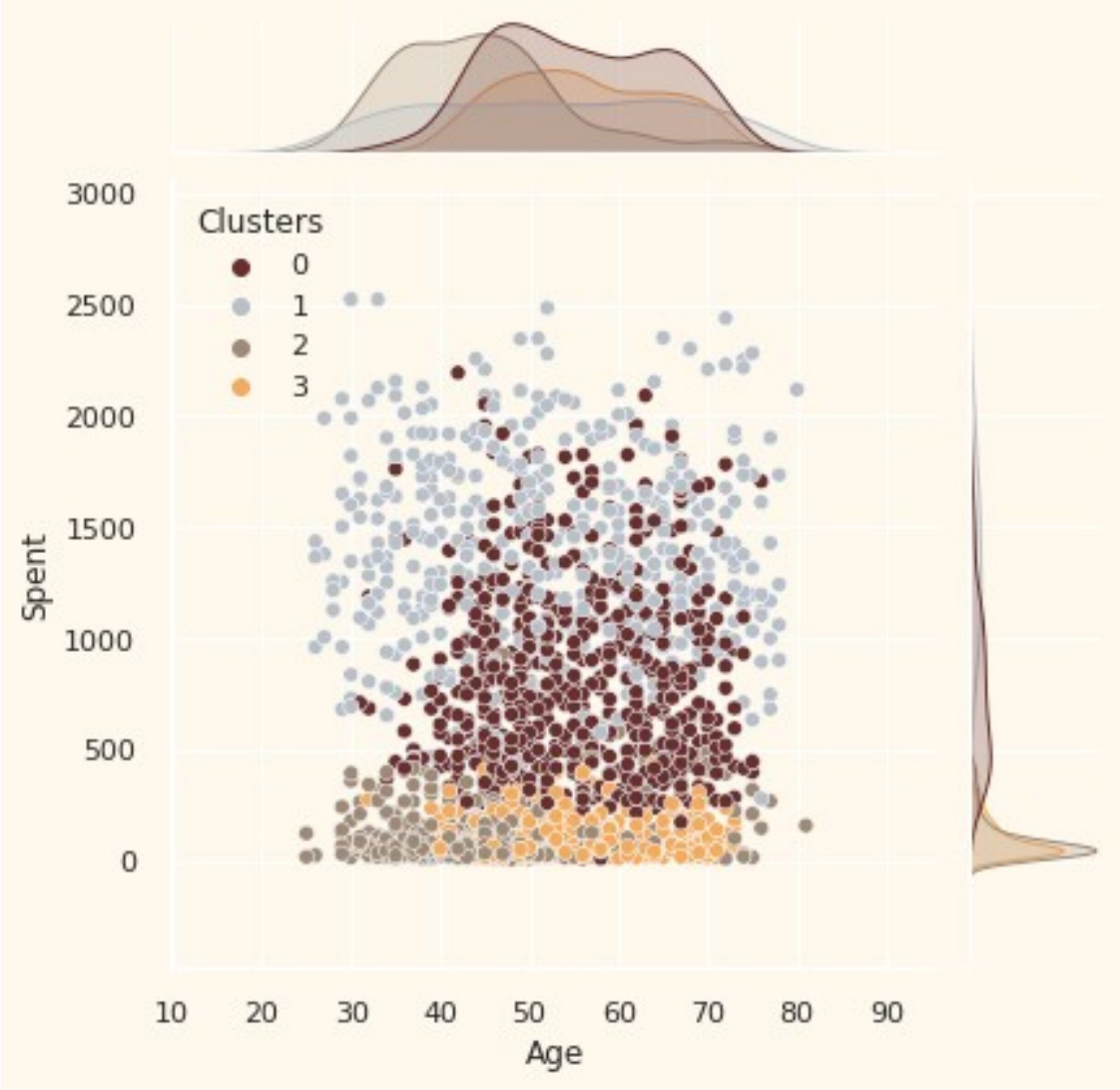
<Figure size 432x288 with 0 Axes>



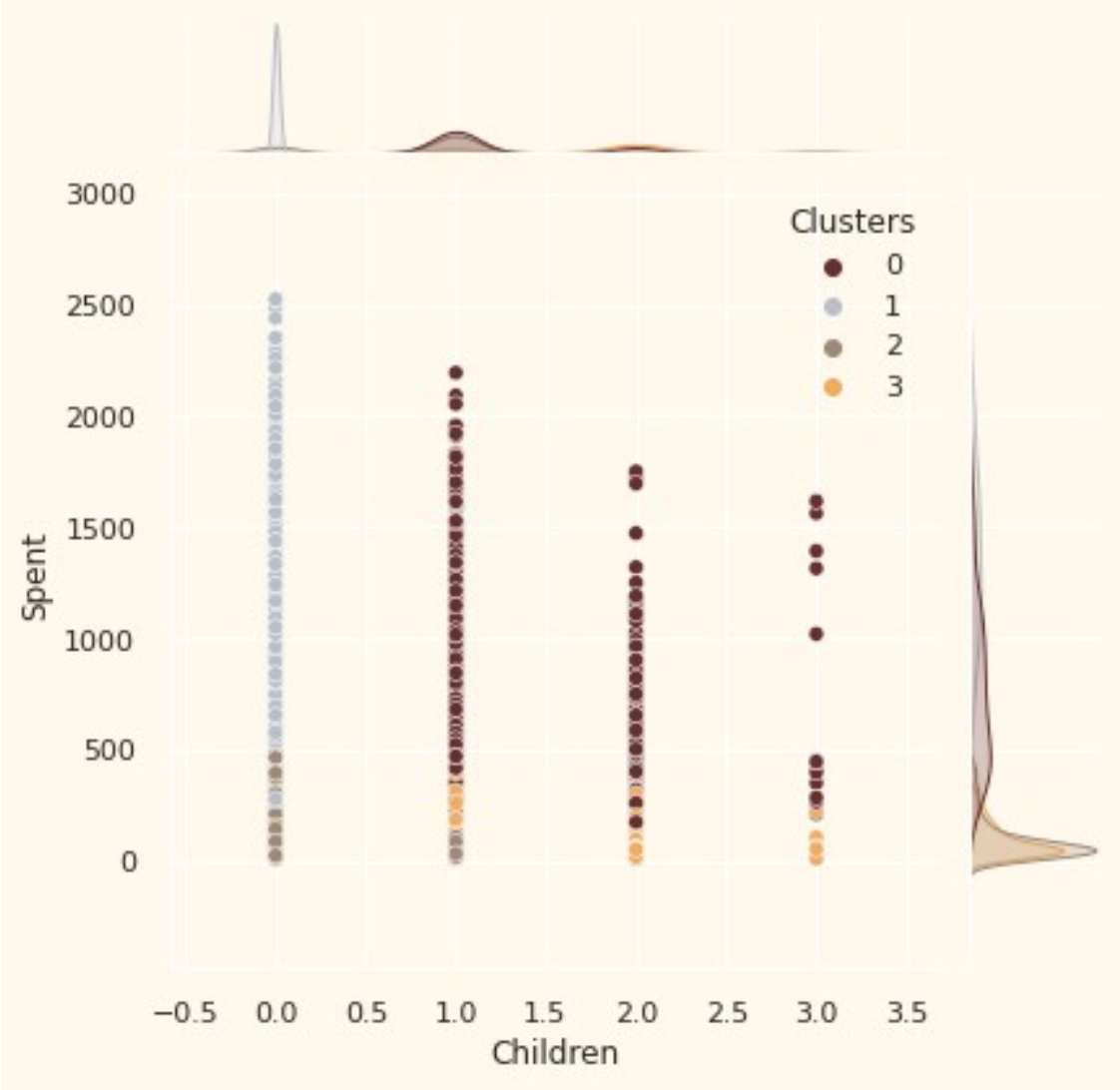
<Figure size 432x288 with 0 Axes>



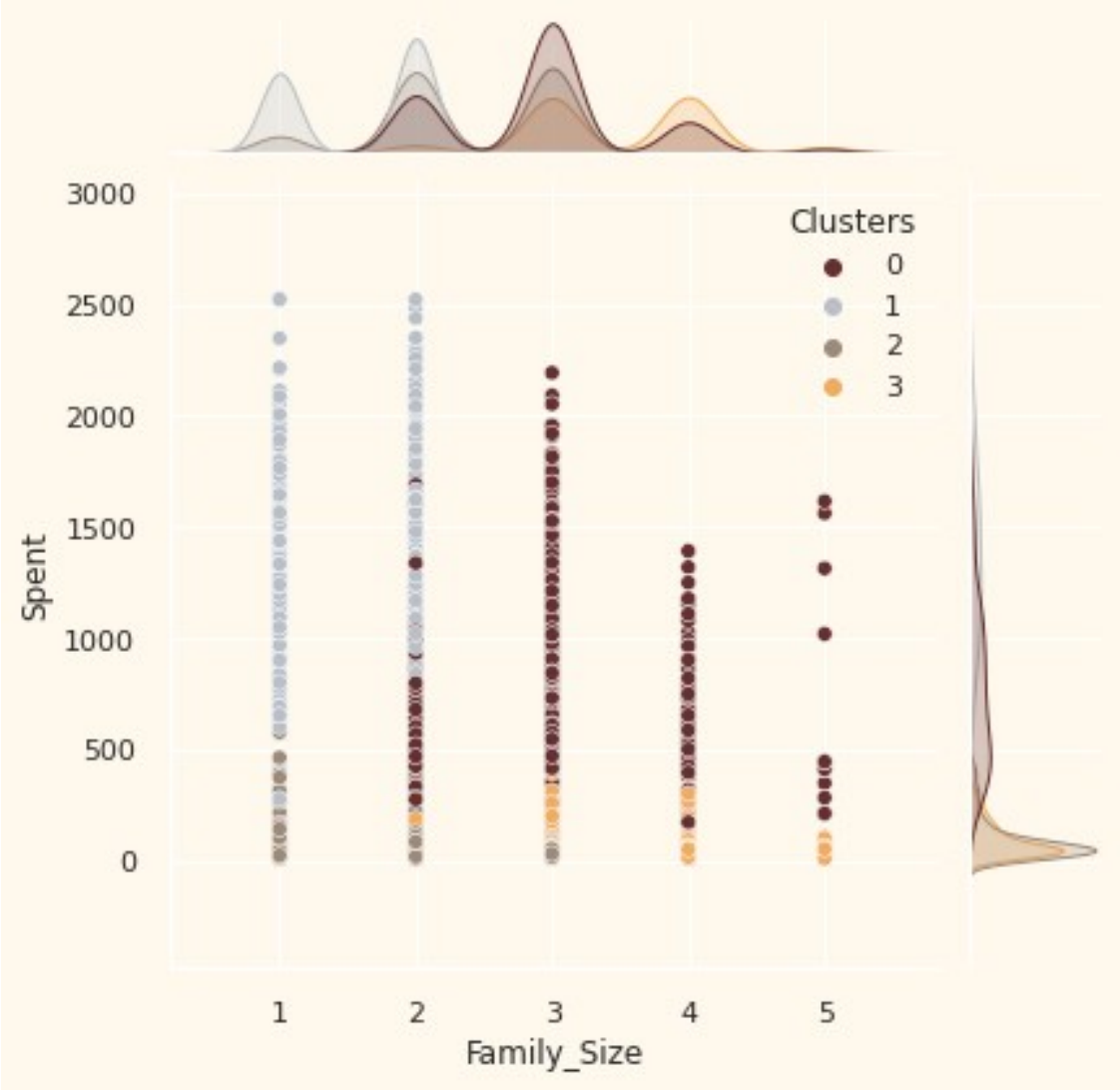
<Figure size 432x288 with 0 Axes>



<Figure size 432x288 with 0 Axes>



<Figure size 432x288 with 0 Axes>



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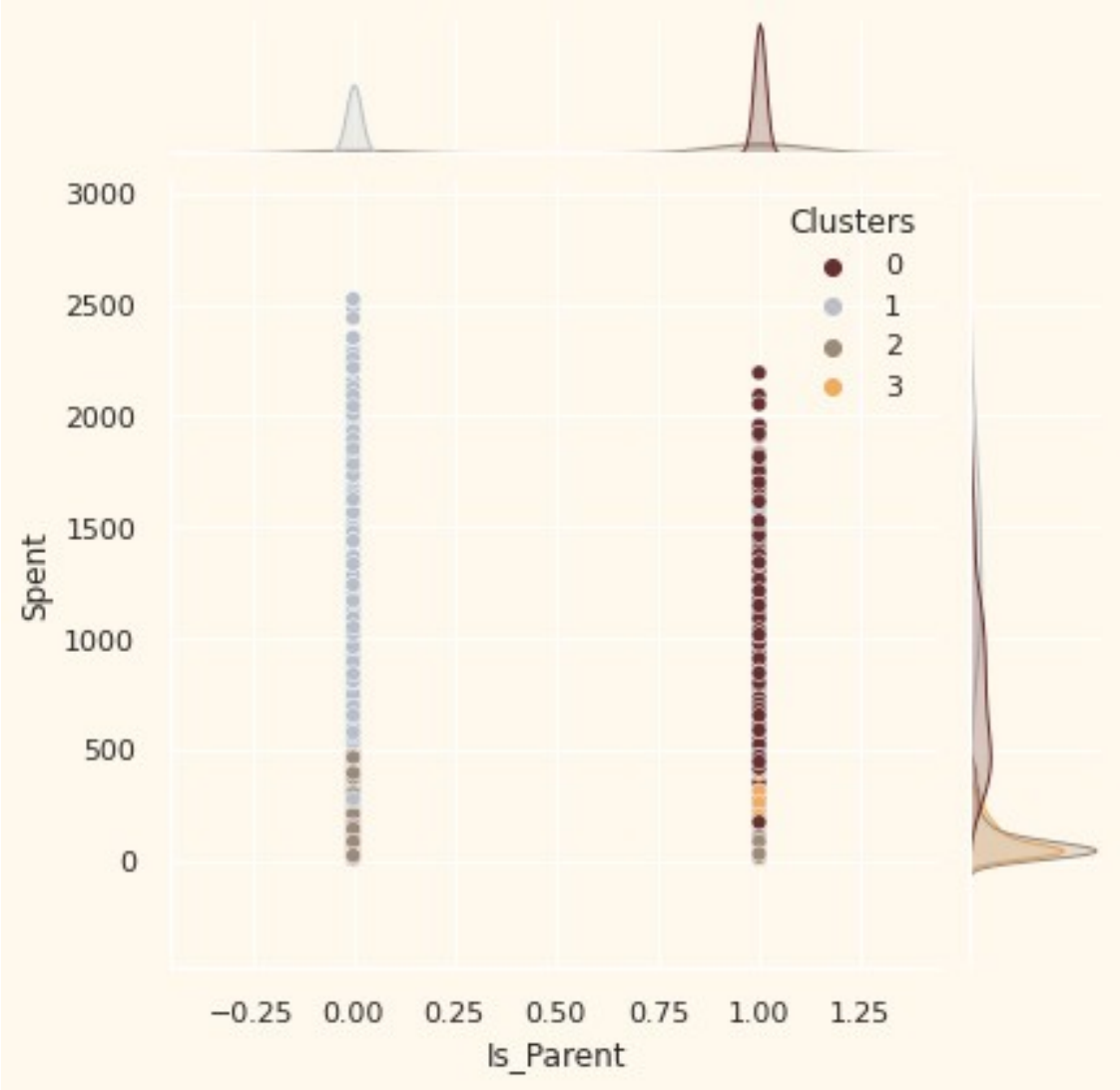

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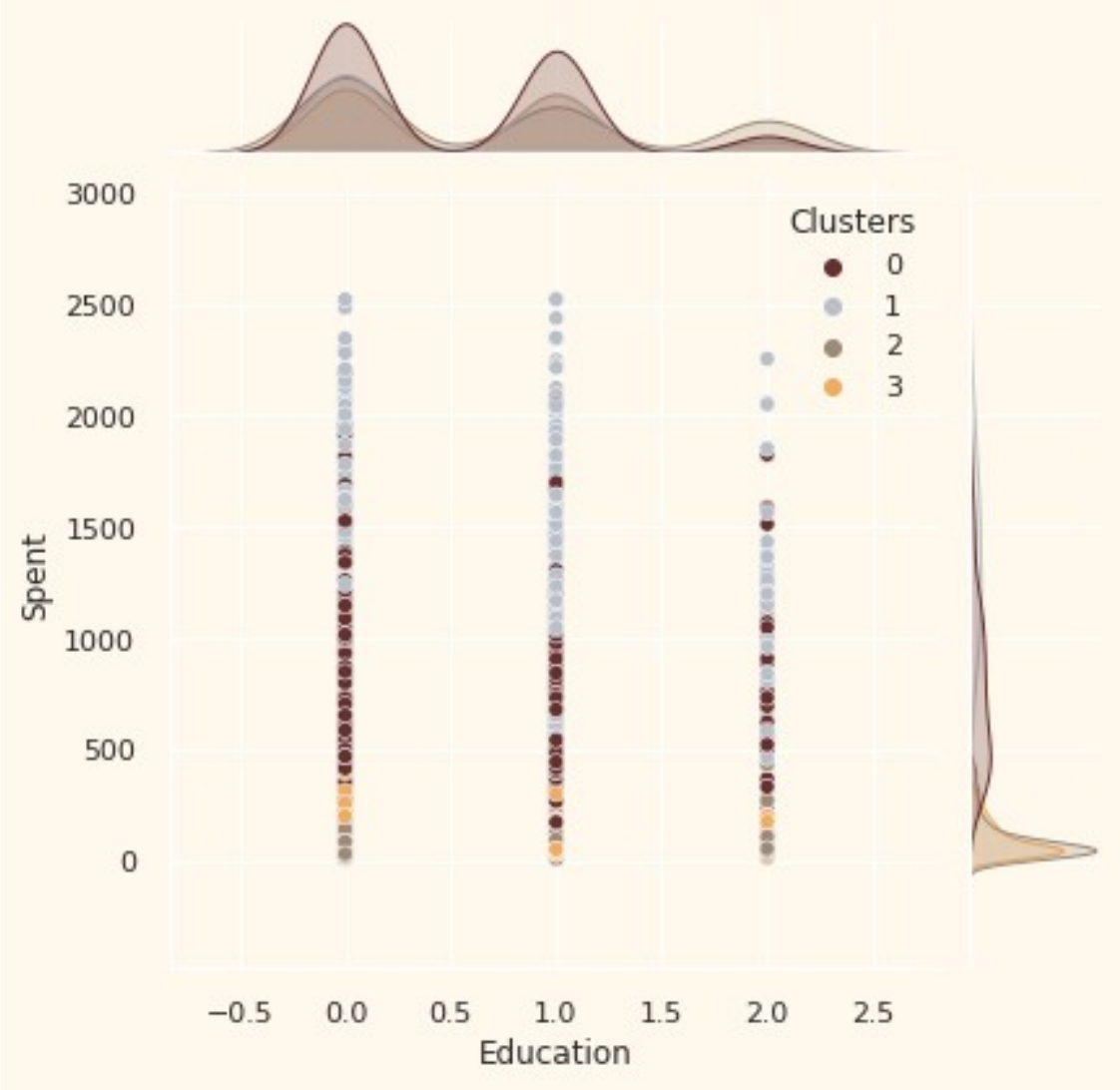

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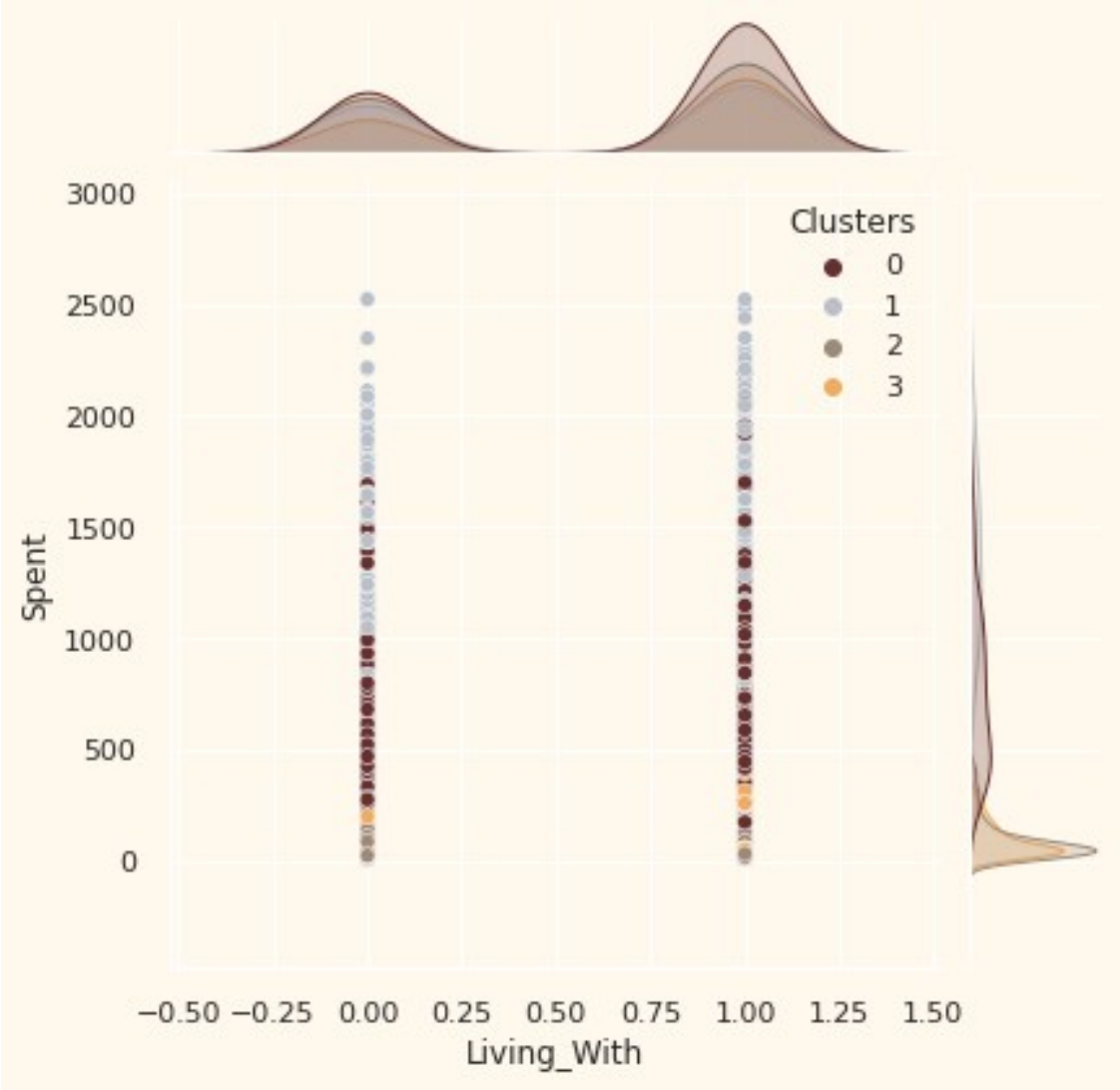
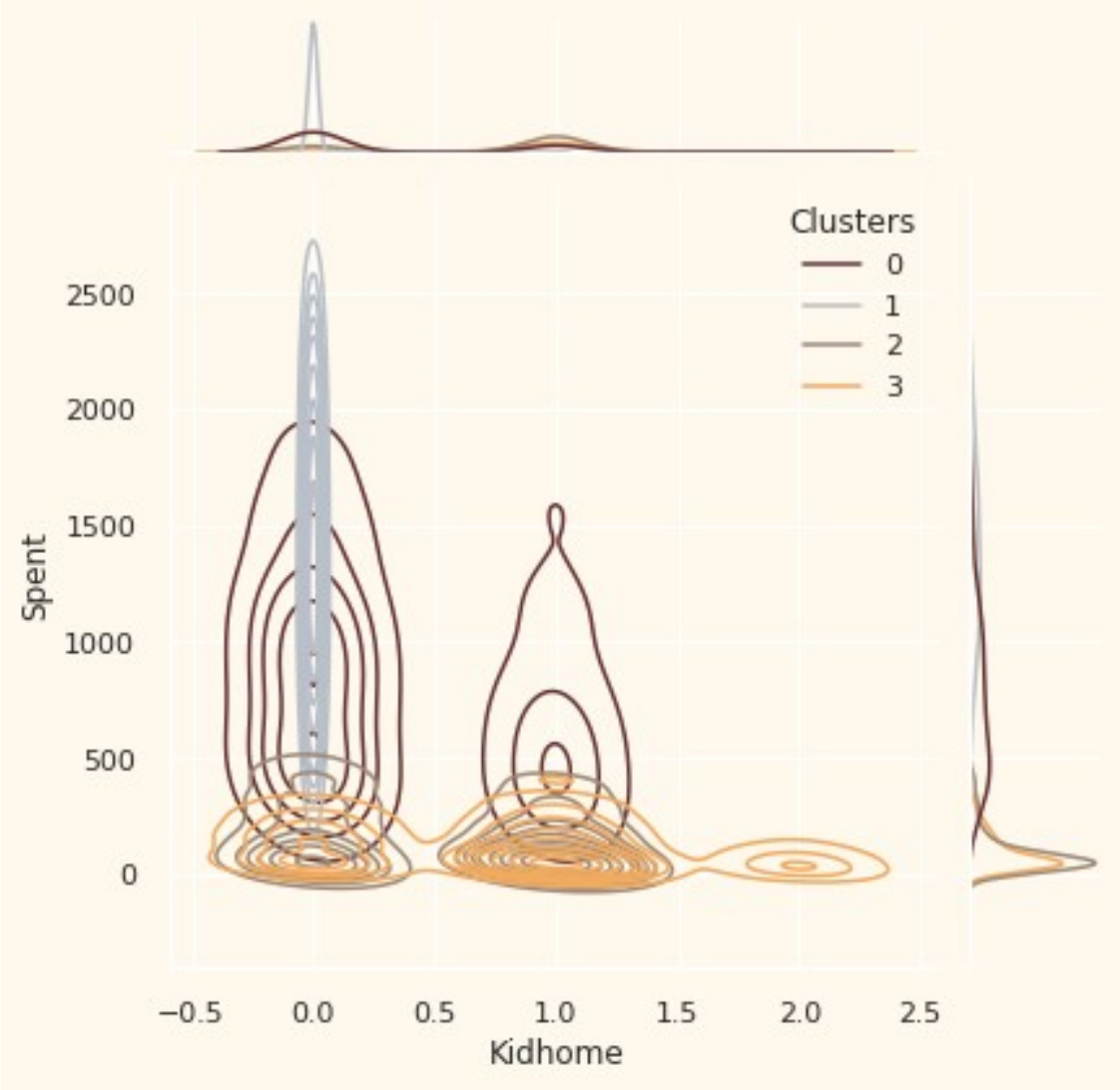



```
# Latihan 10
Personal = [ "Kidhome","Teenhome","Customer_For", "Age", "Children",
"Family_Size", "Is_Parent", "Education","Living_With"]

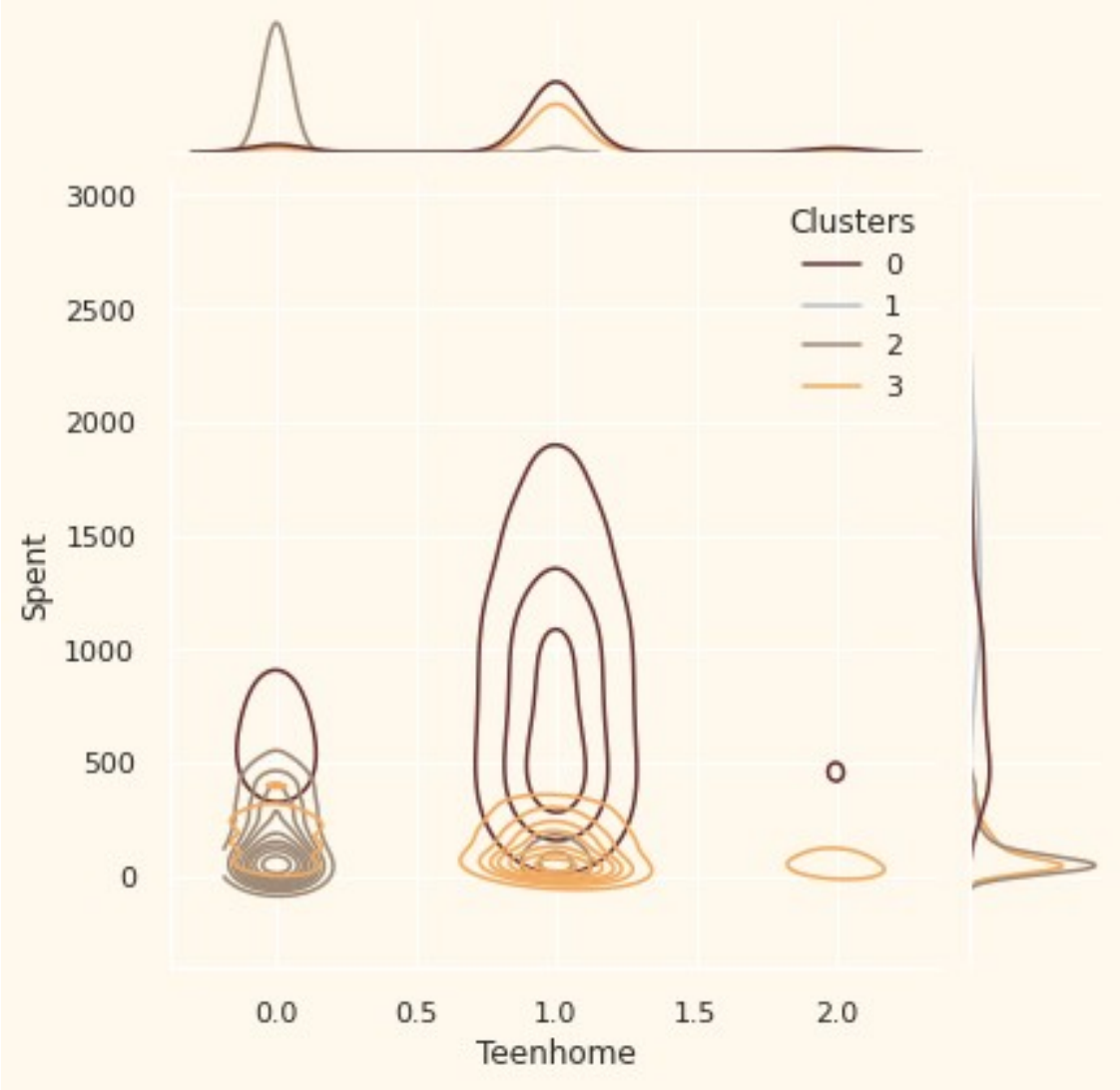
for i in Personal:
    plt.figure()
    sns.jointplot(x=data[i], y=data["Spent"], hue =data["Clusters"],
kind="kde", palette=pal)
    plt.show()
```

```
<Figure size 432x288 with 0 Axes>
```




```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:316:
UserWarning: Dataset has 0 variance; skipping density estimate. Pass
`warn_singular=False` to disable this warning.
  warnings.warn(msg, UserWarning)

<Figure size 432x288 with 0 Axes>
```



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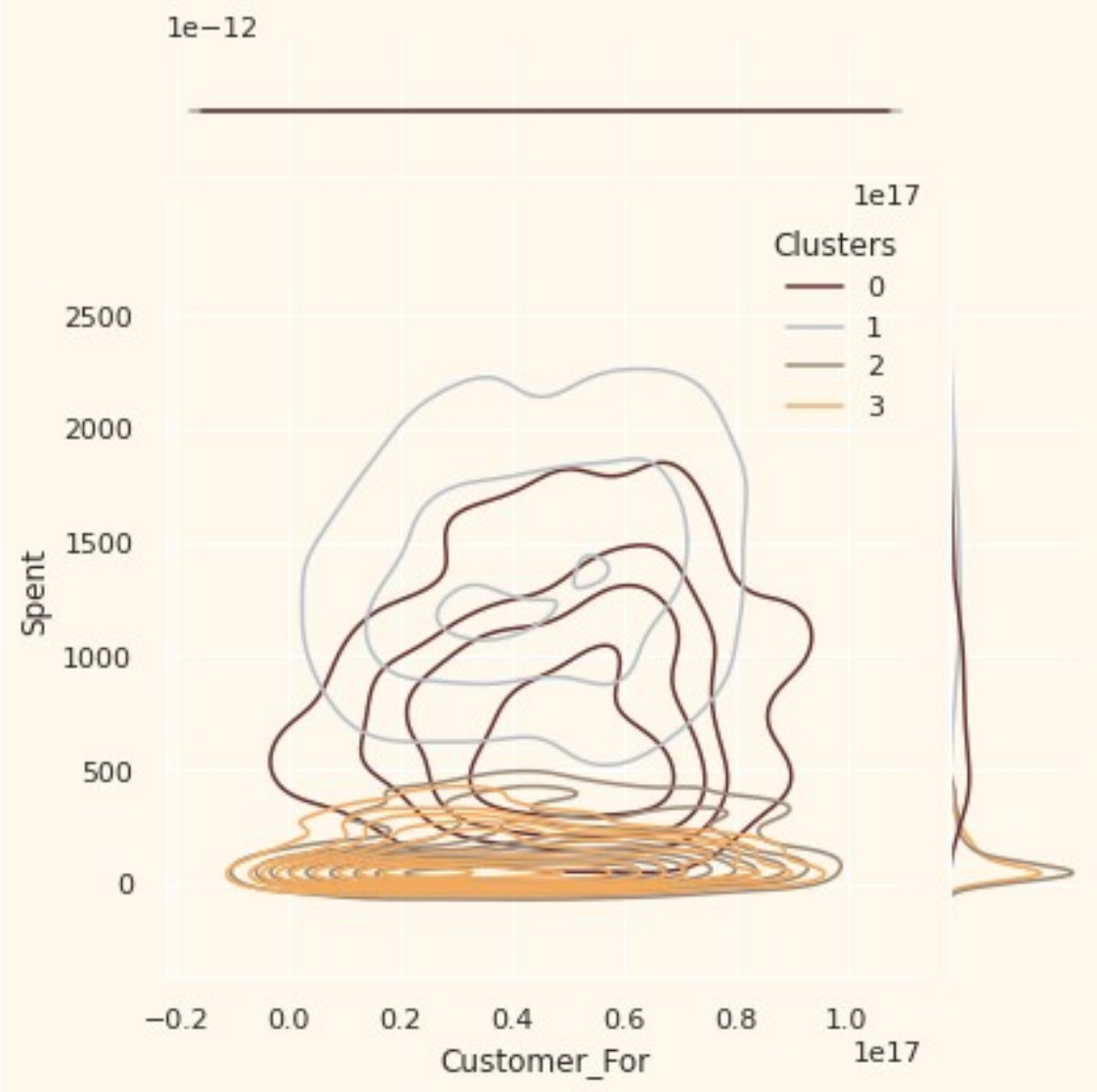

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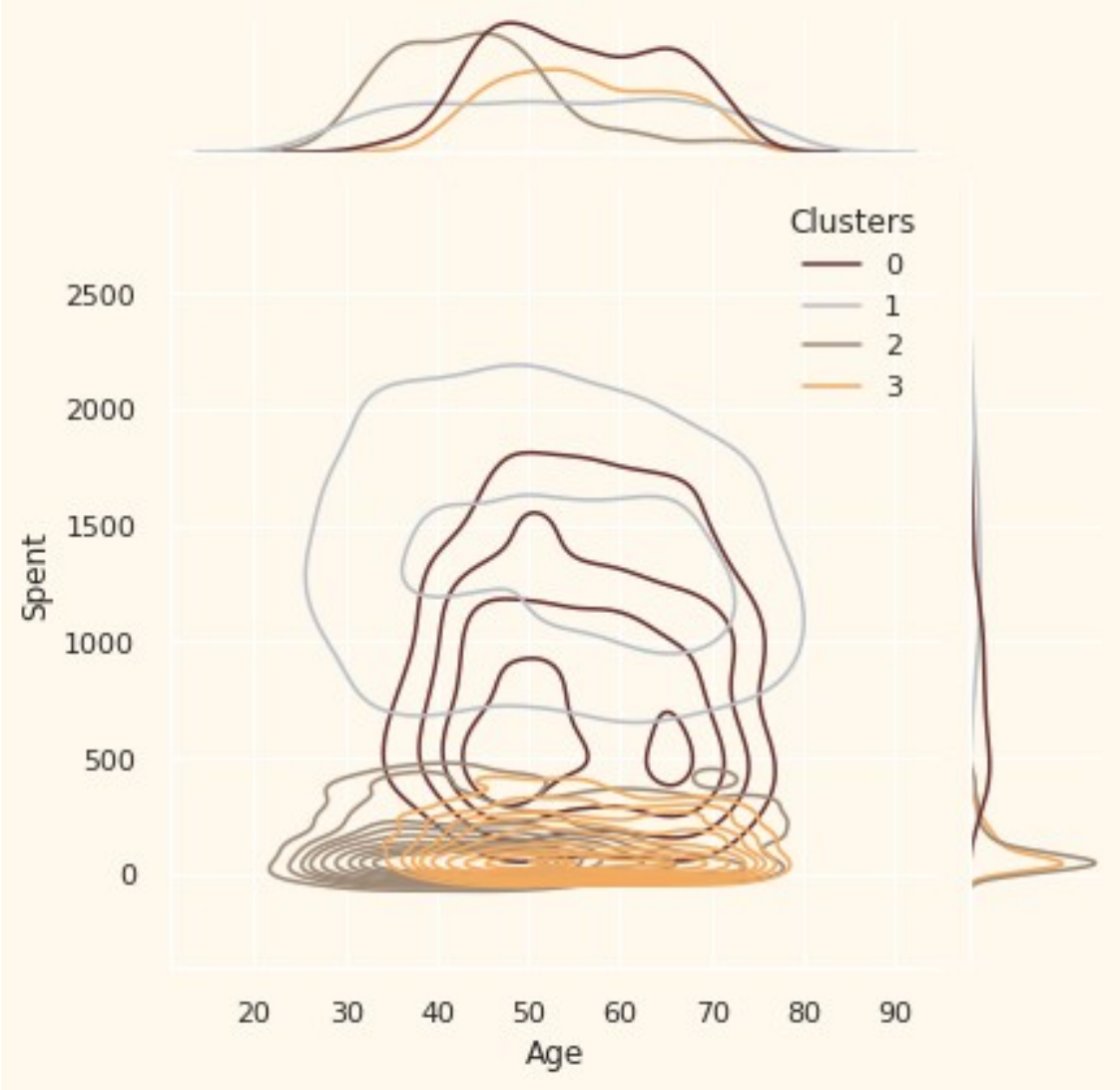

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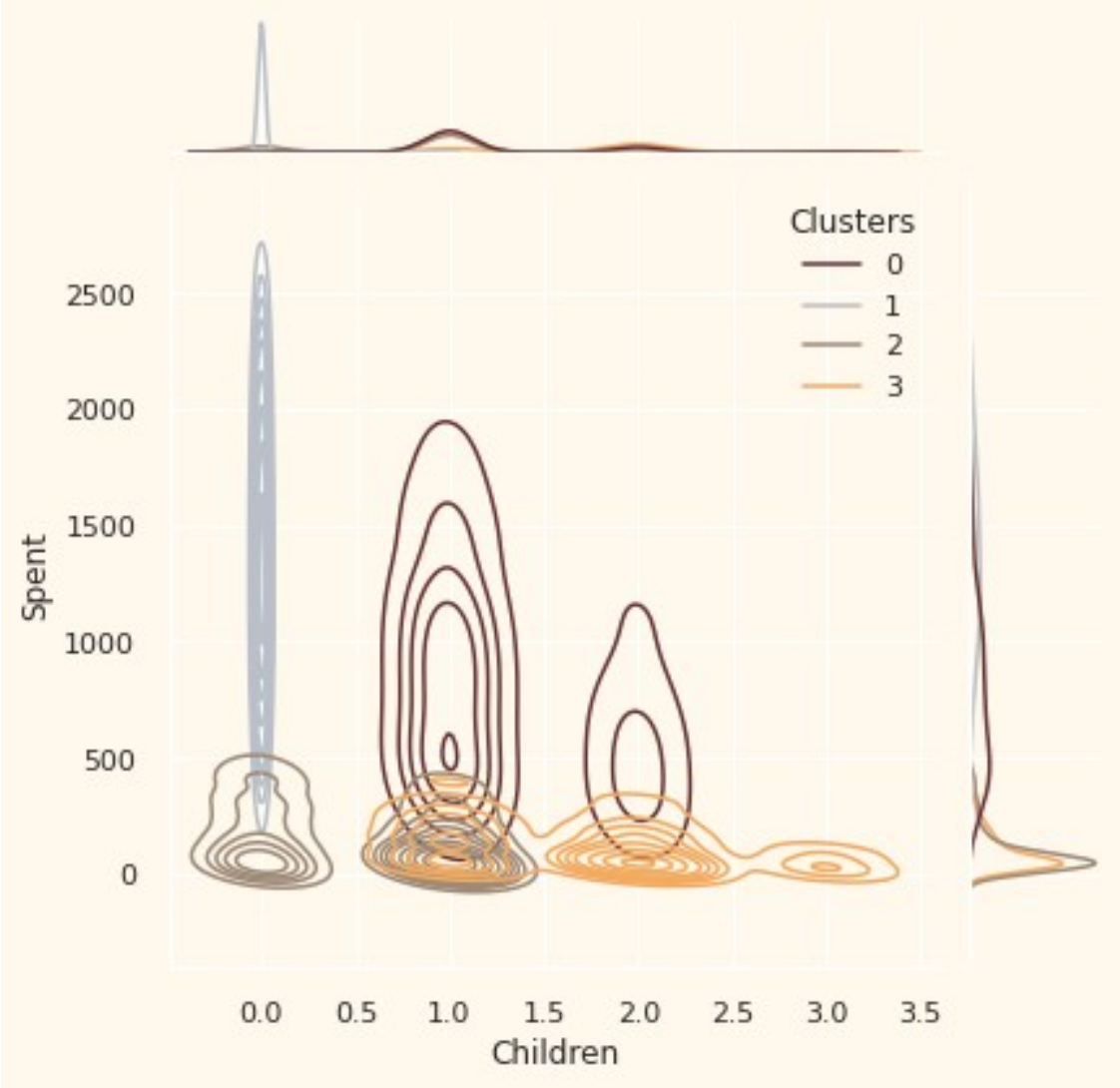

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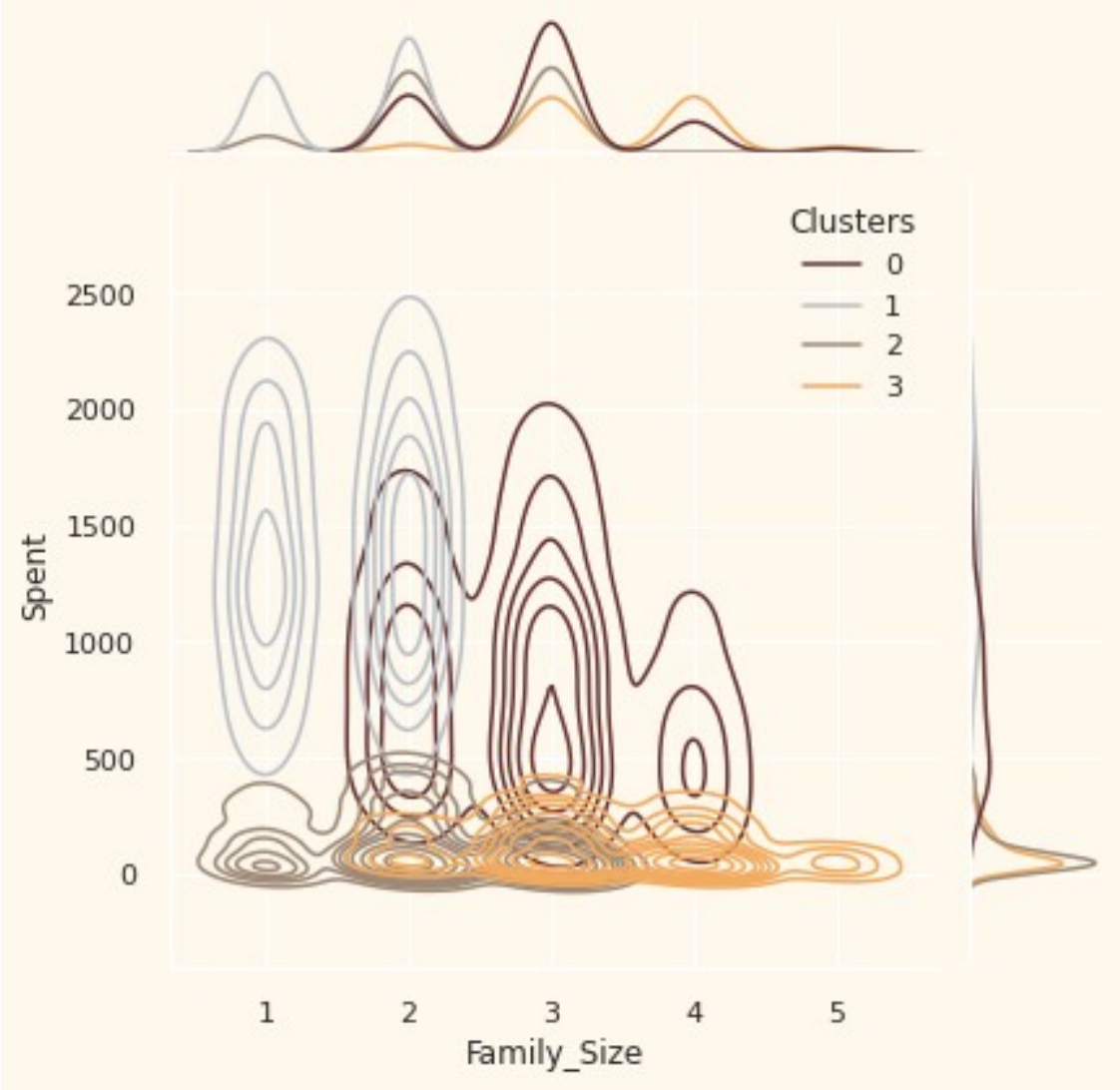


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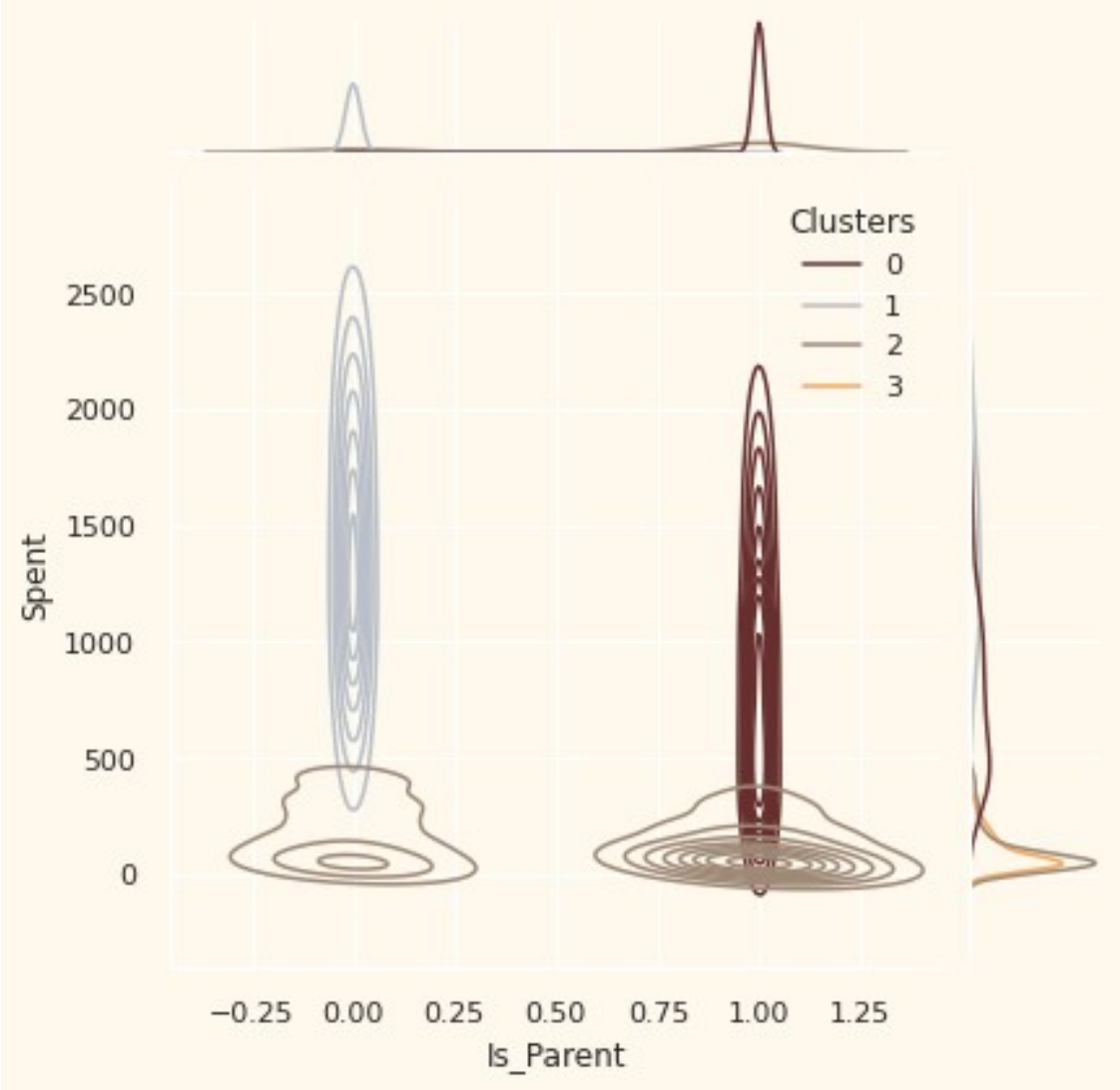
<Figure size 432x288 with 0 Axes>
```



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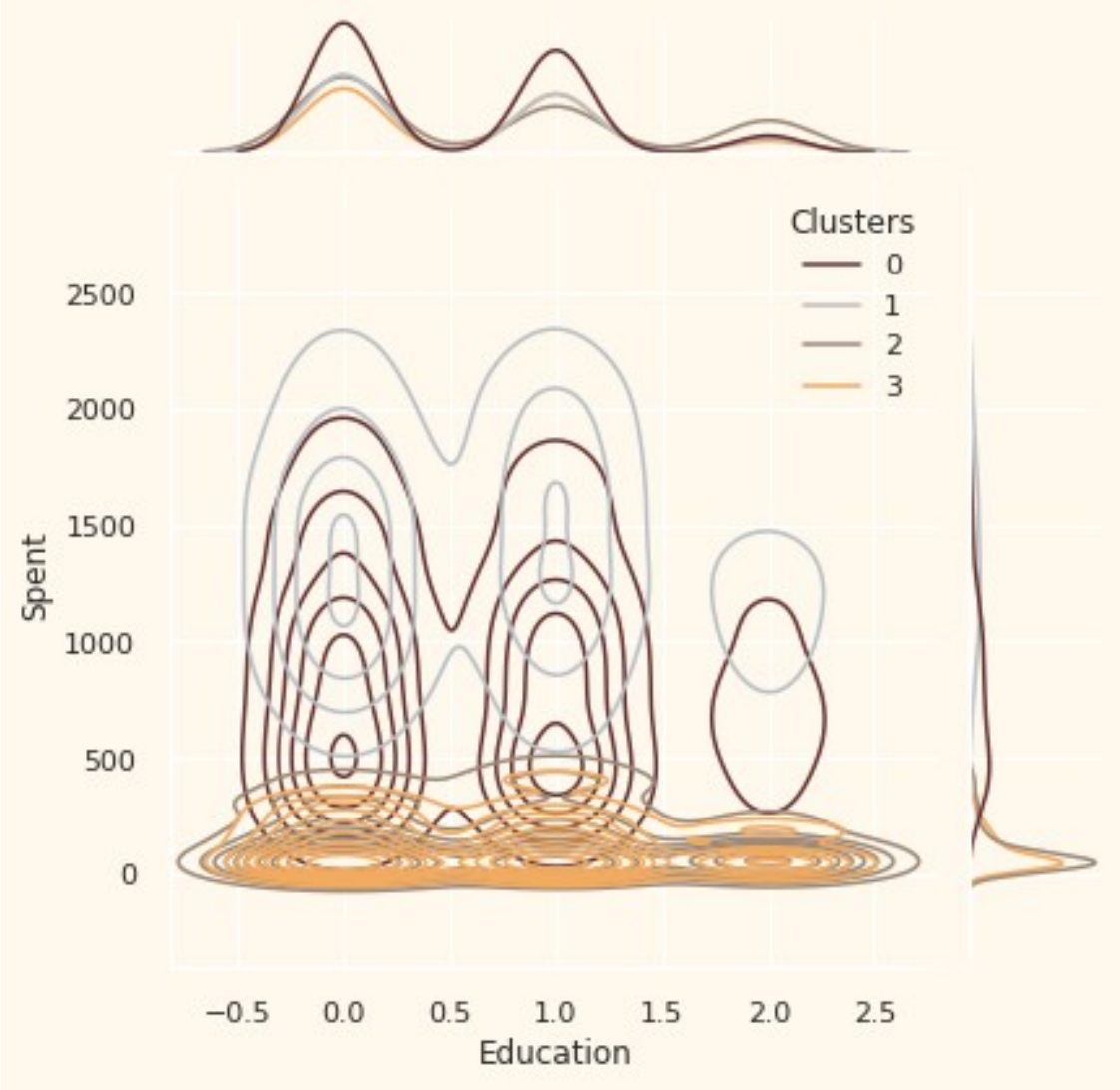

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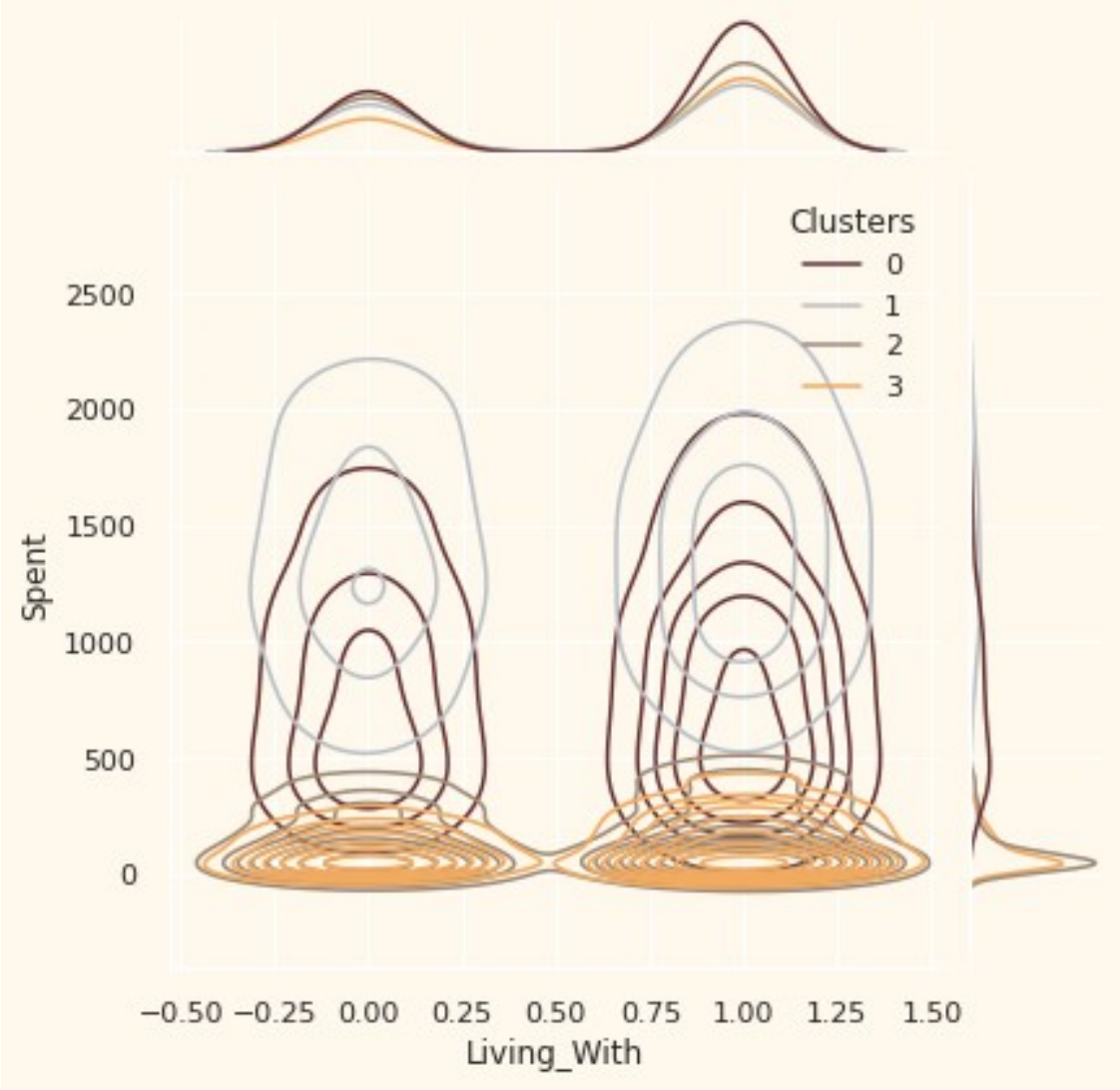
Clusters
0
1
2
3
2500
2000
1500
1000
500
0
Spent
−0.50 −0.25 0.00 0.25 0.50 0.75 1.00 1.25 1.50
Living_With