In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:

```
df = pd.read_csv('bank-additional.csv',delimiter=';')
df.head()
```

Out[2]:

	age	job	marital	education	default	housing	loan	contact	month	day_of_week	...	campaign	pdays	previous	poutc
0	30	blue-collar	married	basic.9y	no	yes	no	cellular	may	fri	...	2	999	0	nonexi
1	39	services	single	high.school	no	no	no	telephone	may	fri	...	4	999	0	nonexi
2	25	services	married	high.school	no	yes	no	telephone	jun	wed	...	1	999	0	nonexi
3	38	services	married	basic.9y	no	unknown	unknown	telephone	jun	fri	...	3	999	0	nonexi
4	47	admin.	married	university.degree	no	yes	no	cellular	nov	mon	...	1	999	0	nonexi

5 rows × 21 columns

In [3]:

```
df.tail()
```

Out[3]:

	age	job	marital	education	default	housing	loan	contact	month	day_of_week	...	campaign	pdays	previous	poutco
4114	30	admin.	married	basic.6y	no	yes	yes	cellular	jul	thu	...	1	999	0	nonexist
4115	39	admin.	married	high.school	no	yes	no	telephone	jul	fri	...	1	999	0	nonexist
4116	27	student	single	high.school	no	no	no	cellular	may	mon	...	2	999	1	fail
4117	58	admin.	married	high.school	no	no	no	cellular	aug	fri	...	1	999	0	nonexist
4118	34	management	single	high.school	no	yes	no	cellular	nov	wed	...	1	999	0	nonexist

5 rows × 21 columns

In [4]:

```
df.shape
```

Out[4]:

```
(4119, 21)
```

In [5]:

```
df.columns
```

Out[5]:

```
Index(['age', 'job', 'marital', 'education', 'default', 'housing', 'loan',
       'contact', 'month', 'day_of_week', 'duration', 'campaign', 'pdays',
       'previous', 'poutcome', 'emp.var.rate', 'cons.price.idx',
       'cons.conf.idx', 'euribor3m', 'nr.employed', 'y'],
      dtype='object')
```

In [6]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4119 entries, 0 to 4118
Data columns (total 21 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   age             4119 non-null   int64  
 1   job             4119 non-null   object 
 2   marital         4119 non-null   object 
 3   education       4119 non-null   object 
 4   default         4119 non-null   object 
 5   housing         4119 non-null   object 
 6   loan            4119 non-null   object 
 7   contact         4119 non-null   object 
 8   month           4119 non-null   object 
 9   day_of_week     4119 non-null   object 
 10  duration        4119 non-null   int64  
 11  campaign        4119 non-null   int64  
 12  pdays           4119 non-null   int64  
 13  previous        4119 non-null   int64  
 14  poutcome        4119 non-null   object 
 15  emp.var.rate    4119 non-null   float64
 16  cons.price.idx  4119 non-null   float64
 17  cons.conf.idx   4119 non-null   float64
 18  euribor3m       4119 non-null   float64
 19  nr.employed     4119 non-null   float64
 20  y               4119 non-null   object 
dtypes: float64(5), int64(5), object(11)
memory usage: 675.9+ KB
```

In [7]:

```
df.describe()
```

Out[7]:

	age	duration	campaign	pdays	previous	emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employe
count	4119.000000	4119.000000	4119.000000	4119.000000	4119.000000	4119.000000	4119.000000	4119.000000	4119.000000	4119.00000
mean	40.113620	256.788055	2.537266	960.422190	0.190337	0.084972	93.579704	-40.499102	3.621356	5166.48169
std	10.313362	254.703736	2.568159	191.922786	0.541788	1.563114	0.579349	4.594578	1.733591	73.66790
min	18.000000	0.000000	1.000000	0.000000	0.000000	-3.400000	92.201000	-50.800000	0.635000	4963.60000
25%	32.000000	103.000000	1.000000	999.000000	0.000000	-1.800000	93.075000	-42.700000	1.334000	5099.10000
50%	38.000000	181.000000	2.000000	999.000000	0.000000	1.100000	93.749000	-41.800000	4.857000	5191.00000
75%	47.000000	317.000000	3.000000	999.000000	0.000000	1.400000	93.994000	-36.400000	4.961000	5228.10000
max	88.000000	3643.000000	35.000000	999.000000	6.000000	1.400000	94.767000	-26.900000	5.045000	5228.10000

In [8]:

```
df.isnull().sum()
```

Out[8]:

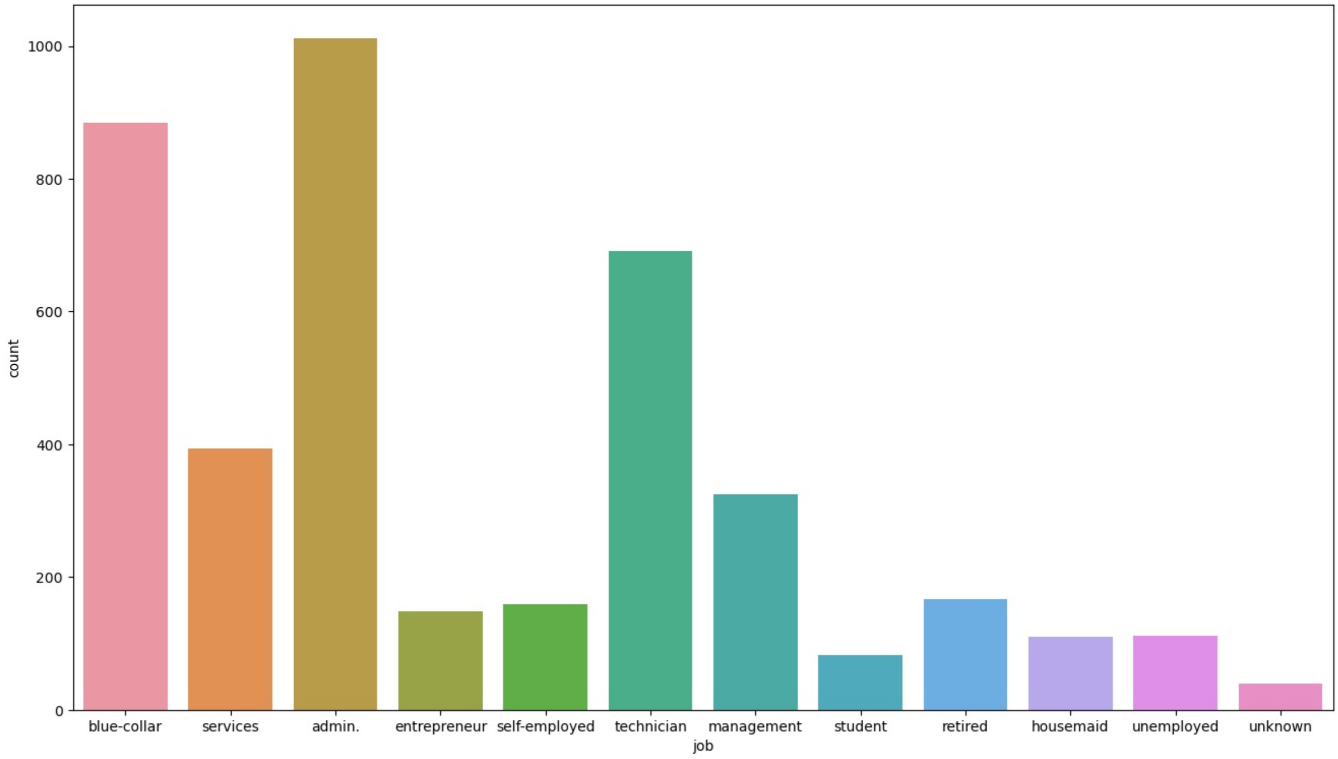
```
age               0
job               0
marital           0
education         0
default           0
housing           0
loan              0
contact           0
month             0
day_of_week       0
duration          0
campaign          0
pdays             0
previous          0
poutcome          0
emp.var.rate      0
cons.price.idx    0
cons.conf.idx     0
euribor3m         0
nr.employed       0
y                 0
dtype: int64
```

In [9]:

```
plt.figure(figsize = (16,9))
sns.countplot(x = "job",data = df)
```

Out[9]:

```
<Axes: xlabel='job', ylabel='count'>
```

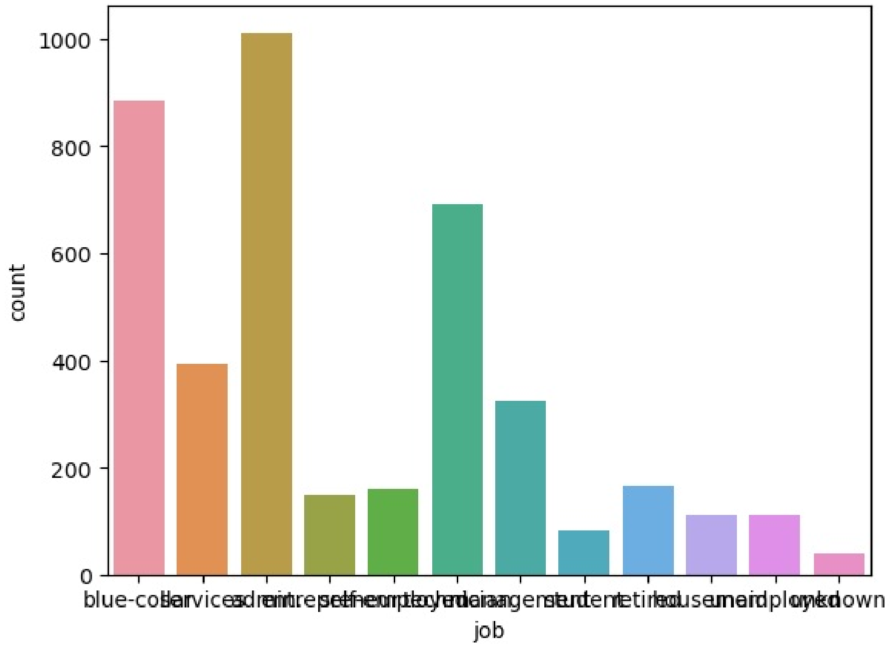


In [10]:

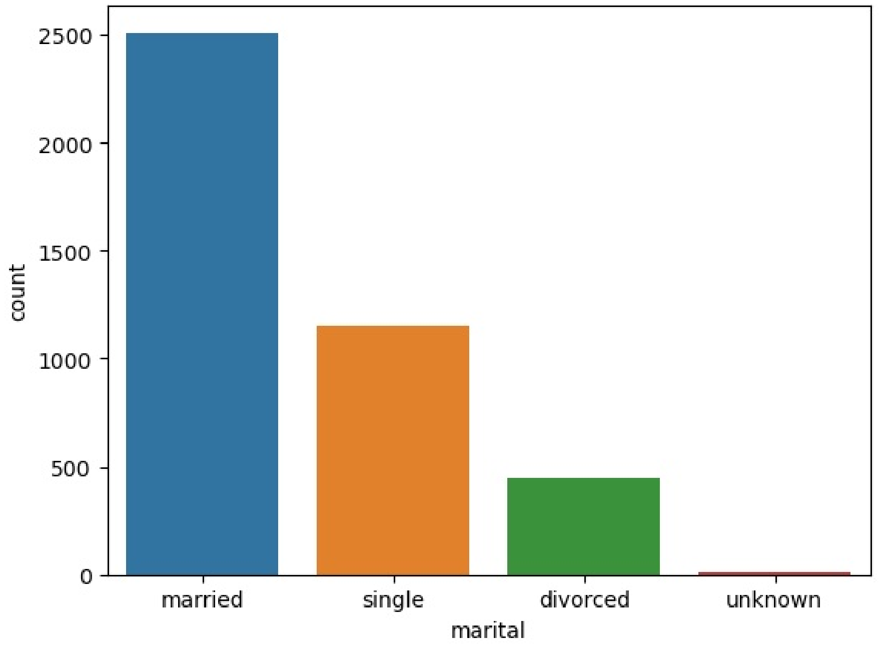
```
sns.countplot(x = "job",data = df)
```

Out[10]:

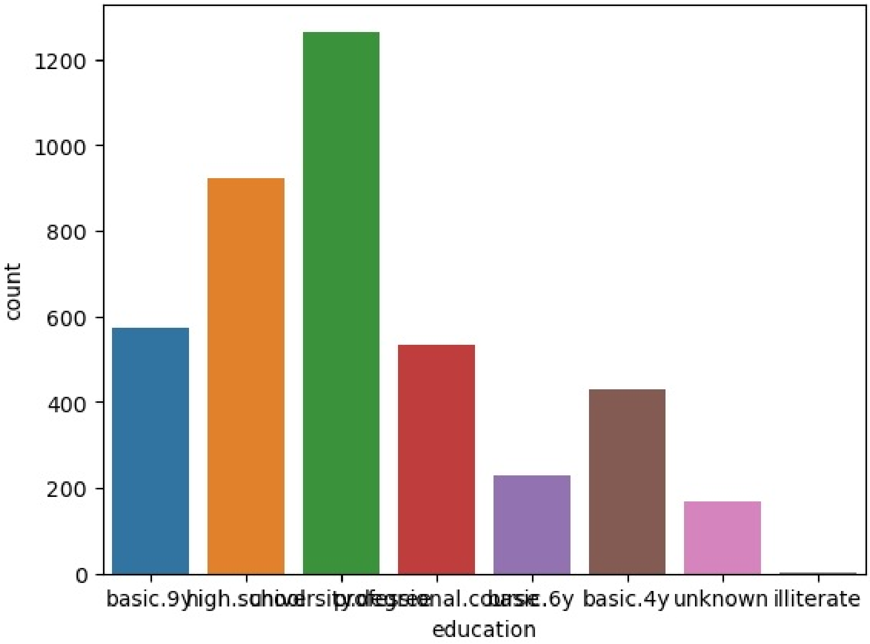
```
<Axes: xlabel='job', ylabel='count'>
```



In [11]:
```
sns.countplot(x = "marital",data = df)
```
Out[11]:
```
<Axes: xlabel='marital', ylabel='count'>
```



In [12]:
```
sns.countplot(x = "education",data = df)
```
Out[12]:
```
<Axes: xlabel='education', ylabel='count'>
```

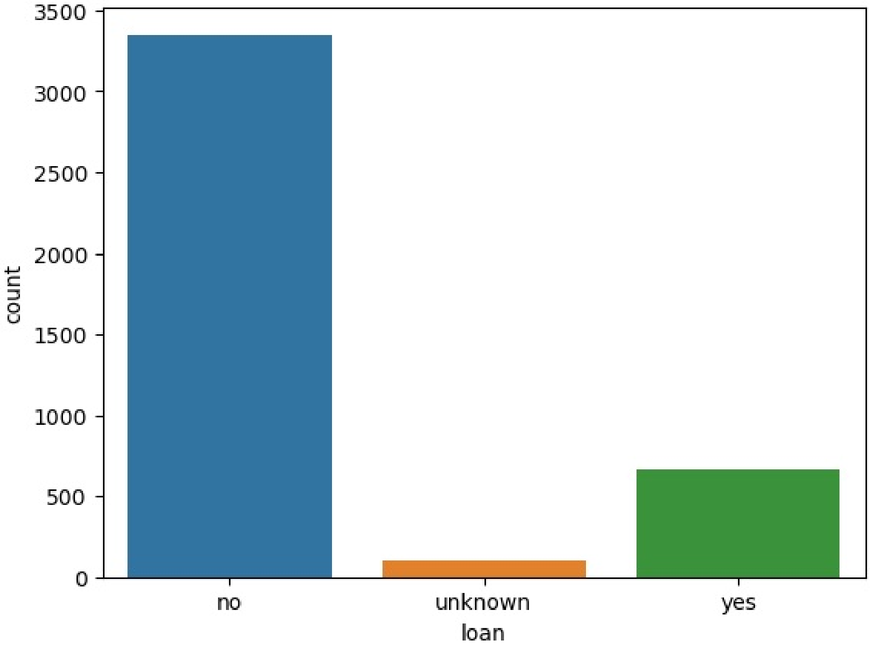


In [13]:

```python
sns.countplot(x = "loan",data = df)
```

Out[13]:

```
<Axes: xlabel='loan', ylabel='count'>
```

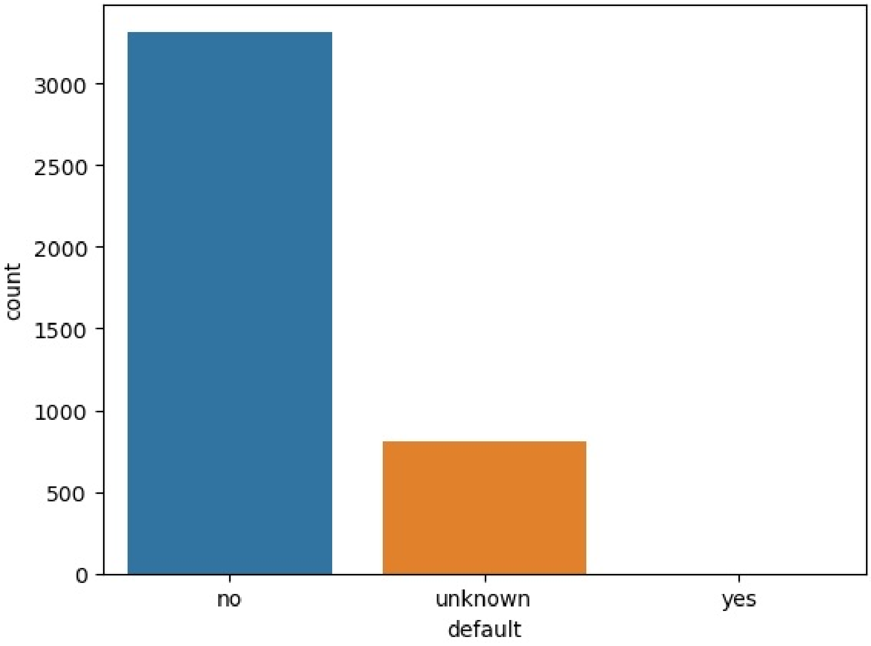


In [14]:

```python
sns.countplot(x = "default",data = df)
```

Out[14]:

```
<Axes: xlabel='default', ylabel='count'>
```



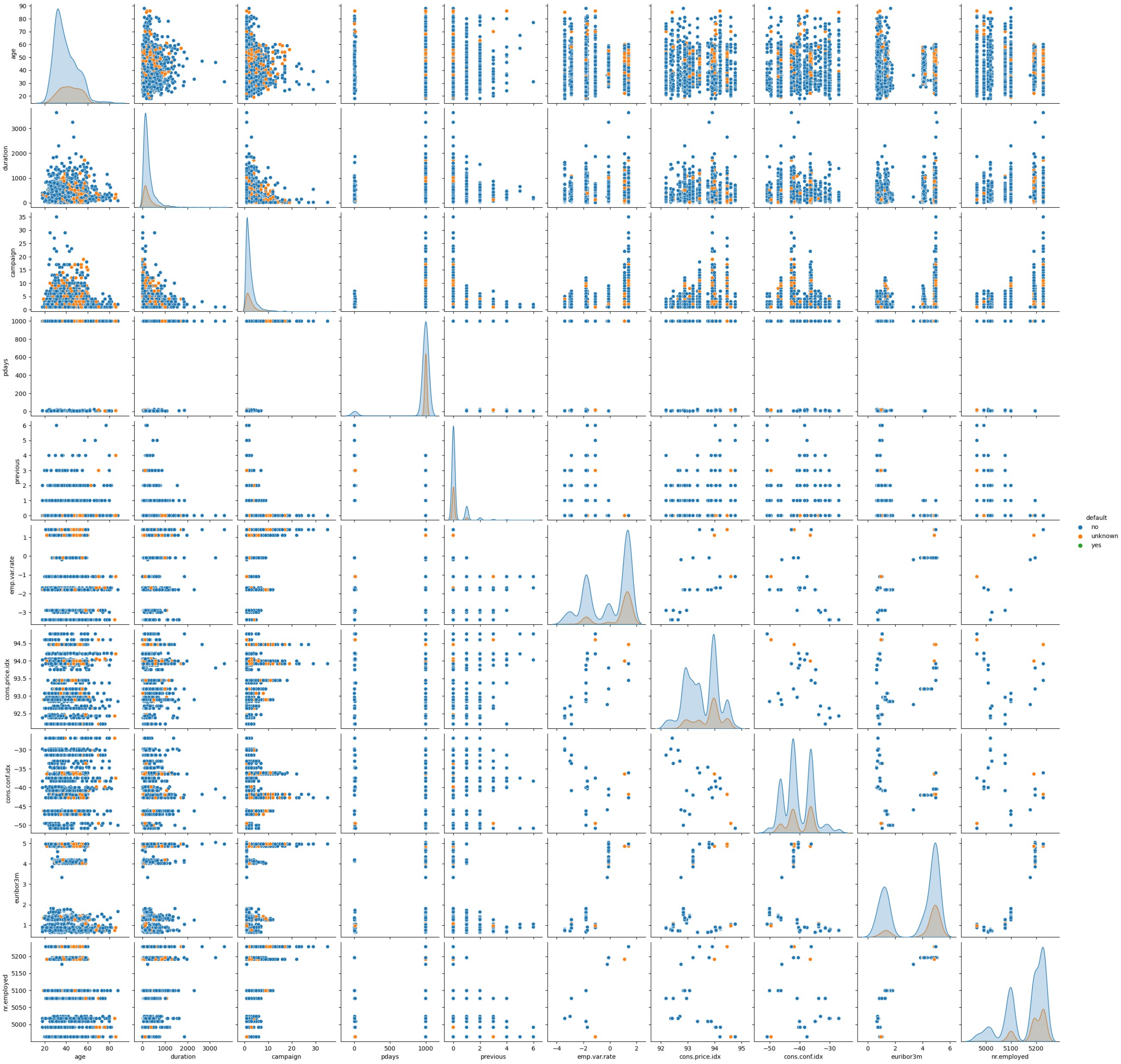
In [15]:

```
plt.figure(figsize = (16,9))
sns.pairplot(data = df,hue = "default")
```

Out[15]:

```
<seaborn.axisgrid.PairGrid at 0x12c128fba50>

<Figure size 1600x900 with 0 Axes>
```



In [16]:

```python
my_df=df.select_dtypes(exclude=[object])
my_df.corr()
```

Out[16]:

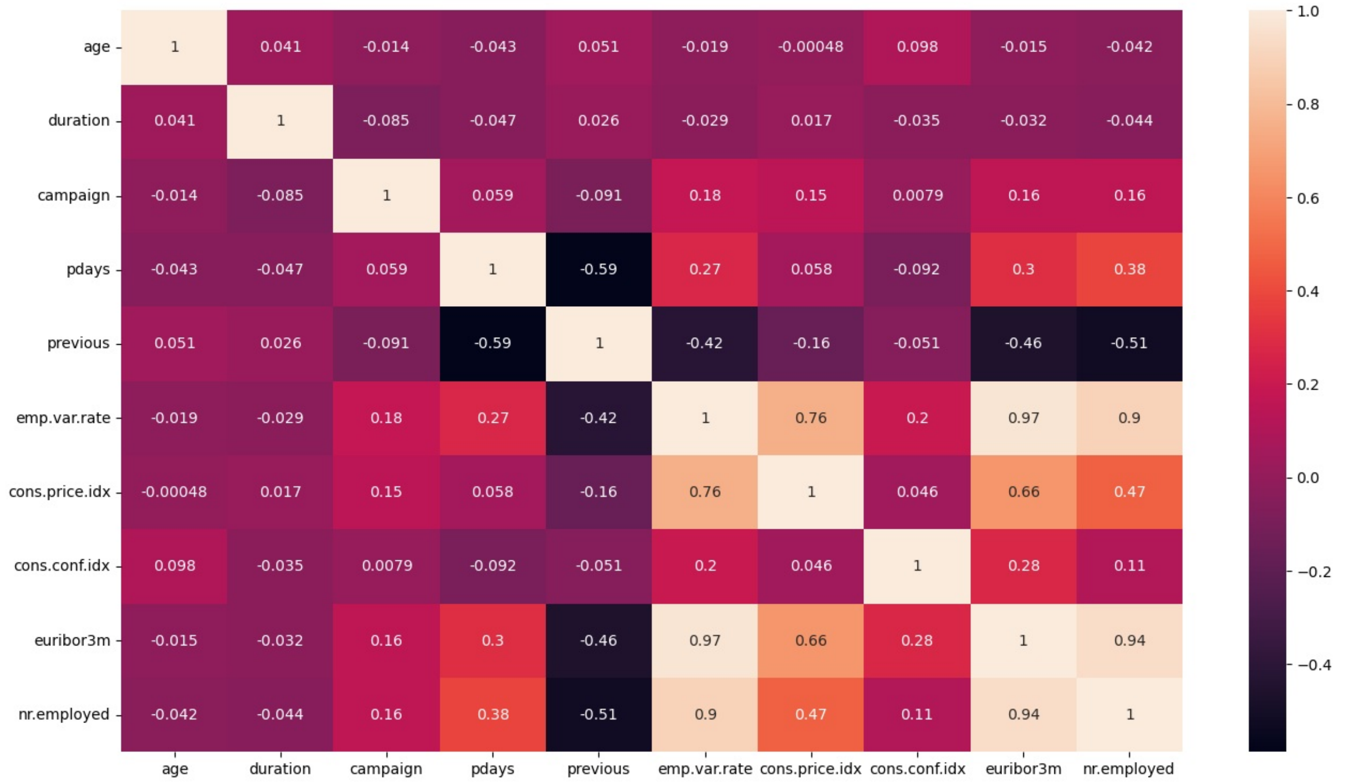
	age	duration	campaign	pdays	previous	emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employed
age	1.000000	0.041299	-0.014169	-0.043425	0.050931	-0.019192	-0.000482	0.098135	-0.015033	-0.041936
duration	0.041299	1.000000	-0.085348	-0.046998	0.025724	-0.028848	0.016672	-0.034745	-0.032329	-0.044218
campaign	-0.014169	-0.085348	1.000000	0.058742	-0.091490	0.176079	0.145021	0.007882	0.159435	0.161037
pdays	-0.043425	-0.046998	0.058742	1.000000	-0.587941	0.270684	0.058472	-0.092090	0.301478	0.381983
previous	0.050931	0.025724	-0.091490	-0.587941	1.000000	-0.415238	-0.164922	-0.051420	-0.458851	-0.514853
emp.var.rate	-0.019192	-0.028848	0.176079	0.270684	-0.415238	1.000000	0.755155	0.195022	0.970308	0.897173
cons.price.idx	-0.000482	0.016672	0.145021	0.058472	-0.164922	0.755155	1.000000	0.045835	0.657159	0.472560
cons.conf.idx	0.098135	-0.034745	0.007882	-0.092090	-0.051420	0.195022	0.045835	1.000000	0.276595	0.107054
euribor3m	-0.015033	-0.032329	0.159435	0.301478	-0.458851	0.970308	0.657159	0.276595	1.000000	0.942589
nr.employed	-0.041936	-0.044218	0.161037	0.381983	-0.514853	0.897173	0.472560	0.107054	0.942589	1.000000

In [17]:

```python
plt.figure(figsize = (16,9))
sns.heatmap(my_df.corr(),annot = True)
```

Out[17]:

```
<Axes: >
```



In [18]:

```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
```

In [19]:

```
df["job"] = le.fit_transform(df["job"])
df["marital"] = le.fit_transform(df["marital"])
df["education"] = le.fit_transform(df["education"])
df["default"] = le.fit_transform(df["default"])
df["loan"] = le.fit_transform(df["loan"])
df["contact"] = le.fit_transform(df["contact"])
df["poutcome"] = le.fit_transform(df["poutcome"])
df["housing"] = le.fit_transform(df["housing"])
df["month"] = le.fit_transform(df["month"])
```

In [20]:

```
df.head()
```

Out[20]:

	age	job	marital	education	default	housing	loan	contact	month	day_of_week	...	campaign	pdays	previous	poutcome	emp.var.rat
0	30	1	1	2	0	2	0	0	6	fri	...	2	999	0	1	-1.
1	39	7	2	3	0	0	0	1	6	fri	...	4	999	0	1	1.
2	25	7	1	3	0	2	0	1	4	wed	...	1	999	0	1	1.
3	38	7	1	2	0	1	1	1	4	fri	...	3	999	0	1	1.
4	47	0	1	6	0	2	0	0	7	mon	...	1	999	0	1	-0.

5 rows × 21 columns

In [21]:

```
df.drop(["pdays","previous","poutcome"],axis = 1)
df.head()
```

Out[21]:

	age	job	marital	education	default	housing	loan	contact	month	day_of_week	...	campaign	pdays	previous	poutcome	emp.var.rat
0	30	1	1	2	0	2	0	0	6	fri	...	2	999	0	1	-1.
1	39	7	2	3	0	0	0	1	6	fri	...	4	999	0	1	1.
2	25	7	1	3	0	2	0	1	4	wed	...	1	999	0	1	1.
3	38	7	1	2	0	1	1	1	4	fri	...	3	999	0	1	1.
4	47	0	1	6	0	2	0	0	7	mon	...	1	999	0	1	-0.

5 rows × 21 columns

In [ ]:

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