7.Problem: Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library API.

References: http://pgmpy.org/ and https://www.inertia7.com/projects/55

# 7.1. Constructing a Bayesian Network considering Medical Data

## 7.1.1 Defining a Structure with nodes and edges

```
In [3]:
import pgmpy
# Author : Dr.Thyagaraju G S , Context Innovations Lab , DEpt of CSE , SDMIT - Ujire
# Date : July 11 2018
# Starting with defining the network structure
from pgmpy.models import BayesianModel
cancer model = BayesianModel([('Pollution', 'Cancer'),
                                 ('Smoker', 'Cancer'),
('Cancer', 'Xray'),
('Cancer', 'Dyspnoea')])
In [4]:
print(cancer model)
In [5]:
cancer model.nodes()
Out[5]:
NodeView(('Pollution', 'Cancer', 'Smoker', 'Xray', 'Dyspnoea'))
In [6]:
cancer model.edges()
Out[6]:
OutEdgeView([('Pollution', 'Cancer'), ('Cancer', 'Xray'), ('Cancer', 'Dyspnoea'), ('Smoker',
'Cancer')])
In [7]:
cancer model.get cpds()
Out[7]:
[]
```

# 7.1.2 Creation of Conditional Probability Table

```
In [8]:
```

# 7.1.3 Associating Conditional probabilities with the Bayesian Structure

```
In [9]:
# Associating the parameters with the model structure.
cancer model.add cpds(cpd poll, cpd smoke, cpd cancer, cpd xray, cpd dysp)
# Checking if the cpds are valid for the model.
cancer model.check model()
Out[9]:
In [10]:
# Doing some simple queries on the network
cancer_model.is_active_trail('Pollution', 'Smoker')
Out[10]:
False
In [11]:
cancer_model.is_active_trail('Pollution', 'Smoker', observed=['Cancer'])
Out[11]:
True
In [12]:
cancer model.get cpds()
Out[12]:
[<TabularCPD representing P(Pollution:2) at 0xa305070>,
 <TabularCPD representing P(Smoker:2) at 0xa305090>,
 <TabularCPD representing P(Cancer:2 | Smoker:2, Pollution:2) at 0xa3050d0>,
 <TabularCPD representing P(Xray:2 | Cancer:2) at 0xa305130>,
 <TabularCPD representing P(Dyspnoea:2 | Cancer:2) at 0xa305110>]
In [13]:
print(cancer model.get cpds('Pollution'))
```

Pollution 0 0 9

1011461011_0	J 0.2
Pollution_1	0.1

### In [14]:

```
print(cancer_model.get_cpds('Smoker'))
```

Smoker_0	0.3
Smoker_1	0.7

### In [15]:

```
print(cancer_model.get_cpds('Xray'))
```

Cancer	Cancer_0	Cancer_1		
Xray_0	0.9	0.2		
Xray_1	0.1	0.8		

### In [16]:

```
print(cancer_model.get_cpds('Dyspnoea'))
```

Cancer	Cancer_0	Cancer_1
Dyspnoea_0	0.65	0.3
Dyspnoea_1	0.35	0.7

### In [17]:

```
print(cancer_model.get_cpds('Cancer'))
```

Smoker	Smoker_0	Smoker_0	Smoker_1	Smoker_1
Pollution	Pollution_0	Pollution_1	Pollution_0	Pollution_1
Cancer_0	0.03	0.05	0.001	0.02
Cancer_1	0.97	0.95	0.999	0.98

# 7.1.4 Determining the Local independencies

### In [18]:

```
cancer_model.local_independencies('Xray')
```

### Out[18]:

```
(Xray _| _ Dyspnoea, Pollution, Smoker | Cancer)
```

### In [19]:

```
cancer_model.local_independencies('Pollution')
```

```
Out[19]:
(Pollution | Dyspnoea, Cancer, Smoker, Xray)
In [20]:
cancer model.local independencies('Smoker')
Out[20]:
(Smoker _ | _ Dyspnoea, Cancer, Pollution, Xray)
In [21]:
cancer model.local independencies('Dyspnoea')
Out[21]:
(Dyspnoea | Pollution, Smoker, Xray | Cancer)
In [22]:
cancer model.local independencies('Cancer')
Out[22]:
(Cancer _| _ Dyspnoea, Xray | Pollution, Smoker)
In [23]:
cancer model.get independencies()
Out[23]:
(Pollution _{-}|_ Smoker)
(Pollution _{-}|_ Dyspnoea, Xray | Cancer)
(Pollution _{-}|_ Xray | Dyspnoea, Cancer)
(Pollution _|_ Dyspnoea, Xray | Cancer, Smoker)
(Pollution _|_ Dyspnoea | Cancer, Xray)
(Pollution _|_ Xray | Dyspnoea, Cancer, Smoker)
(Pollution _{-}|_ Dyspnoea | Cancer, Smoker, Xray)
(Smoker _|_ Pollution)
(Smoker _|_ Dyspnoea, Xray | Cancer)
(Smoker _|_ Xray | Dyspnoea, Cancer)
(Smoker _{-}|_ Dyspnoea, Xray | Cancer, Pollution)
(Smoker _|_ Dyspnoea | Cancer, Xray)
(Smoker _ | Xray | Dyspnoea, Cancer, Pollution)
            Dyspnoea | Cancer, Pollution, Xray)
(Xray \_|\_ Dyspnoea, Pollution, Smoker | Cancer)
(Xray _ | Pollution, Smoker | Dyspnoea, Cancer)
(Xray _| _ Dyspnoea, Smoker | Cancer, Pollution)
(Xray _{-}|_ Dyspnoea, Pollution | Cancer, Smoker)
(Xray _{-}|_ Smoker | Dyspnoea, Cancer, Pollution)
(Xray _ | _ Pollution | Dyspnoea, Cancer, Smoker)
(Xray _ | _ Dyspnoea | Cancer, Pollution, Smoker)
(Dyspnoea _{-}|_{-} Pollution, Smoker, Xray | Cancer)
(Dyspnoea _|_ Smoker, Xray | Cancer, Pollution)
(Dyspnoea _|_ Pollution, Xray | Cancer, Smoker)
(Dyspnoea _{-}|_ Pollution, Smoker | Cancer, Xray)
(Dyspnoea _|_ Xray | Cancer, Pollution, Smoker) (Dyspnoea _|_ Smoker | Cancer, Pollution, Xray)
(Dyspnoea | Pollution | Cancer, Smoker, Xray)
```

# 7.1.5.Inferencing with Bayesian Network

```
In [24]:
```

```
# Doing exact inference using Variable Elimination
from pgmpy.inference import VariableElimination
cancer_infer = VariableElimination(cancer_model)
```

```
# Computing the probability of bronc given smoke.
q = cancer_infer.query(variables=['Cancer'], evidence={'Smoker': 1})
print(q['Cancer'])
```

Cancer	phi(Cancer)
Cancer_0	0.0029
Cancer_1	0.9971

#### In [25]:

```
# Computing the probability of bronc given smoke.
q = cancer_infer.query(variables=['Cancer'], evidence={'Smoker': 1})
print(q['Cancer'])
```

Cancer	phi(Cancer)
Cancer_0	0.0029
Cancer_1	0.9971

### In [26]:

```
# Computing the probability of bronc given smoke.
q = cancer_infer.query(variables=['Cancer'], evidence={'Smoker': 1,'Pollution': 1})
print(q['Cancer'])
```

Cancer	phi(Cancer)
Cancer_0	0.0200
Cancer_1	0.9800

# 7.2 Diagnosis of heart patients using standard Heart Disease Data Set

### In [27]:

```
import numpy as np
from urllib.request import urlopen
import urllib
import matplotlib.pyplot as plt # Visuals
import seaborn as sns
import sklearn as skl
import pandas as pd
```

# 7.2.1 Importing Heart Disease Data Set and Customizing

#### In [28]:

```
Cleveland_data_URL = 'http://archive.ics.uci.edu/ml/machine-learning-databases/heart-disease/processed.hungarian.data'

#Hungarian_data_URL = 'http://archive.ics.uci.edu/ml/machine-learning-databases/heart-disease/processed.hungarian.data'

#Switzerland_data_URL = 'http://archive.ics.uci.edu/ml/machine-learning-databases/heart-disease/processed.switzerland.data'

np.set_printoptions(threshold=np.nan) #see a whole array when we output it

names = ['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg', 'thalach', 'exang', 'oldpeak', '
```

```
slope', 'ca', 'thal', 'heartdisease']
heartDisease = pd.read_csv(urlopen(Cleveland_data_URL), names = names) #gets Cleveland data
#HungarianHeartDisease = pd.read_csv(urlopen(Hungarian_data_URL), names = names) #gets Hungary dat
a
#SwitzerlandHeartDisease = pd.read_csv(urlopen(Switzerland_data_URL), names = names) #gets Switzer
land data
#datatemp = [ClevelandHeartDisease, HungarianHeartDisease, SwitzerlandHeartDisease] #combines all
arrays into a list
#heartDisease = pd.concat(datatemp)#combines list into one array
heartDisease.head()
```

#### Out[28]:

	age	sex	ср	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	са	thal	heartdisease
0	28	1	2	130	132	0	2	185	0	0.0	?	?	?	0
1	29	1	2	120	243	0	0	160	0	0.0	?	?	?	0
2	29	1	2	140	?	0	0	170	0	0.0	?	?	?	0
3	30	0	1	170	237	0	1	170	0	0.0	?	?	6	0
4	31	0	2	100	219	0	1	150	0	0.0	?	?	?	0

```
In [29]:
```

```
del heartDisease['ca']
del heartDisease['slope']
del heartDisease['thal']
del heartDisease['oldpeak']
heartDisease = heartDisease.replace('?', np.nan)
heartDisease.dtypes
```

### Out[29]:

int64 int64 sex int64 ср trestbps object object chol object restecg object thalach object exang object heartdisease int64 dtype: object

### In [30]:

```
heartDisease.columns
```

#### Out[30]:

## 7.2.2 Modeling Heart Disease Data

```
In [31]:
```

```
# Learing CPDs using Maximum Likelihood Estimators
model.fit(heartDisease, estimator=MaximumLikelihoodEstimator)
#for cpd in model.get_cpds():
# print("CPD of {variable}:".format(variable=cpd.variable))
# print(cpd)
# print(cpd)
```

### In [32]:

```
print(model.get_cpds('age'))
```

age (28)	0.00383142
age (29)	0.00383142
age(30)	0.00383142
age(31)	0.00766284
age (32)	0.0153257
age (33)	0.00766284
age (34)	0.0153257
age (35)	0.0191571
age (36)	0.0191571
age (37)	0.0306513
age (38)	0.0191571
age (39)	0.0344828
age(40)	0.0191571
age(41)	0.0383142
age(42)	0.0268199
age(43)	0.0421456
age(44)	0.0268199
age (45)	0.0229885
age (46)	0.045977
age (47)	0.0344828
age (48)	0.0613027
age (49)	0.0421456
age (50)	0.045977
age (51)	0.0344828
age (52)	0.0574713
age (53)	0.0383142
age (54)	0.0842912
age (55)	0.0536398
age (56)	0.0306513
age(57)	0.0191571
age (58)	0.0344828
age (59)	0.0229885
1	I I

age(60)	0.00766284
age(61)	0.00766284
age(62)	0.00766284
age(63)	0.00383142
age (65)	0.0114943
age (66)	0

## In [33]:

print(model.get\_cpds('chol'))

	Г	T
heartdisease	heartdisease(0)	heartdisease(1)
chol(100)	0.006134969325153374	0.0
chol (117)	0.0	0.01020408163265306
chol (129)	0.006134969325153374	0.0
chol (132)	0.006134969325153374	0.0
chol (147)	0.012269938650306749	0.0
chol (156)	0.0	0.01020408163265306
chol (160)	0.012269938650306749	0.01020408163265306
chol (161)	0.006134969325153374	0.0
chol (163)	0.006134969325153374	0.0
chol (164)	0.0	0.01020408163265306
chol (166)	0.006134969325153374	0.0
chol(167)	0.006134969325153374	0.0
chol(168)	0.006134969325153374	0.0
chol(171)	0.006134969325153374	0.0
chol (172)	0.0	0.01020408163265306
chol(173)	0.006134969325153374	0.0
chol (175)	0.0	0.01020408163265306
chol (179)	0.012269938650306749	0.0
chol(180)	0.006134969325153374	0.01020408163265306
chol(182)	0.012269938650306749	0.01020408163265306
chol(184)	0.018404907975460124	0.0
chol(186)	0.006134969325153374	0.01020408163265306
chol(187)	0.006134969325153374	0.0
chol (188)	0.012269938650306749	0.0
chol(190)	0.006134969325153374	0.0
chol(193)	0.006134969325153374	0.02040816326530612
chol (194)	0.012269938650306749	0.0
chol (195)	0.018404907975460124	0.0

chol (196)	0.018404907975460124	0.01020408163265306
chol (198)	0.012269938650306749	0.01020408163265306
chol (200)	0.012269938650306749	0.0
chol (201)	0.012269938650306749	0.01020408163265306
chol (202)	0.006134969325153374	0.01020408163265306
chol (204)	0.006134969325153374	0.0
chol (205)	0.0	0.01020408163265306
chol (206)	0.0	0.01020408163265306
chol(207)	0.012269938650306749	0.01020408163265306
chol (208)	0.006134969325153374	0.0
chol(209)	0.012269938650306749	0.0
chol(210)	0.006134969325153374	0.0
chol (211)	0.018404907975460124	0.01020408163265306
chol(212)	0.0	0.01020408163265306
chol(213)	0.006134969325153374	0.02040816326530612
chol (214)	0.006134969325153374	0.01020408163265306
chol(215)	0.024539877300613498	0.0
chol(216)	0.012269938650306749	0.02040816326530612
chol(217)	0.006134969325153374	0.0
chol(218)	0.006134969325153374	0.0
chol (219)	0.006134969325153374	0.01020408163265306
chol (220)	0.018404907975460124	0.0
chol (221)	0.006134969325153374	0.0
chol (222)	0.006134969325153374	0.02040816326530612
chol (223)	0.012269938650306749	0.01020408163265306
chol (224)	0.018404907975460124	0.01020408163265306
chol (225)	0.012269938650306749	0.01020408163265306
chol (226)	0.0	0.01020408163265306
chol (227)	0.006134969325153374	0.0
chol (228)	0.006134969325153374	0.0
chol (229)	0.006134969325153374	0.0
chol (230)	0.024539877300613498	0.01020408163265306
chol (231)	0.0	0.02040816326530612
chol (233)	0.0	0.01020408163265306
chol (234)	0.0	0.01020408163265306
chol(237)	0.012269938650306749	0.01020408163265306
chol (238)	0.024539877300613498	0.0
chol (240)	0.006134969325153374	0.0
chol (241)	n nn6134969325153374	n n

C11OT (711)	0.0001010000011	···
chol (242)	0.0	0.01020408163265306
chol (243)	0.012269938650306749	0.0
chol (245)	0.012269938650306749	0.0
chol(246)	0.012269938650306749	0.030612244897959183
chol(247)	0.0	0.01020408163265306
chol(248)	0.0	0.030612244897959183
chol (249)	0.012269938650306749	0.0
chol(250)	0.012269938650306749	0.0
chol (251)	0.006134969325153374	0.0
chol (253)	0.012269938650306749	0.0
chol (254)	0.012269938650306749	0.0
chol (255)	0.0	0.01020408163265306
chol (256)	0.006134969325153374	0.0
chol (257)	0.006134969325153374	0.01020408163265306
chol(259)	0.006134969325153374	0.0
chol (260)	0.018404907975460124	0.01020408163265306
chol(263)	0.006134969325153374	0.030612244897959183
chol(264)	0.006134969325153374	0.02040816326530612
chol (265)	0.0	0.02040816326530612
chol (266)	0.006134969325153374	0.01020408163265306
chol (267)	0.0	0.01020408163265306
chol (268)	0.006134969325153374	0.02040816326530612
chol (269)	0.006134969325153374	0.0
chol (270)	0.006134969325153374	0.01020408163265306
chol (271)	0.006134969325153374	0.0
chol(272)	0.006134969325153374	0.01020408163265306
chol(273)	0.012269938650306749	0.0
chol(274)	0.006134969325153374	0.0
chol(275)	0.012269938650306749	0.02040816326530612
chol (276)	0.012269938650306749	0.0
chol (277)	0.006134969325153374	0.01020408163265306
chol (279)	0.0	0.01020408163265306
chol (280)	0.006134969325153374	0.01020408163265306
chol (281)	0.006134969325153374	0.0
chol (282)	0.0	0.01020408163265306
chol (283)	0.006134969325153374	0.0
chol (284)	0.012269938650306749	0.0
chol (285)	0.0	0.01020408163265306

		T
chol(287)	0.006134969325153374	0.0
chol(288)	0.0	0.030612244897959183
chol(289)	0.006134969325153374	0.01020408163265306
chol(290)	0.0	0.01020408163265306
chol(291)	0.006134969325153374	0.02040816326530612
chol(292)	0.012269938650306749	0.01020408163265306
chol(294)	0.006134969325153374	0.01020408163265306
chol (295)	0.006134969325153374	0.0
chol(297)	0.012269938650306749	0.0
chol(298)	0.006134969325153374	0.01020408163265306
chol(303)	0.0	0.01020408163265306
chol(305)	0.006134969325153374	0.0
chol(306)	0.0	0.01020408163265306
chol(307)	0.006134969325153374	0.0
chol(308)	0.012269938650306749	0.0
chol (309)	0.0	0.0
chol (312)	0.006134969325153374	0.0
chol (315)	0.006134969325153374	0.0
chol(318)	0.006134969325153374	0.0
chol (320)	0.012269938650306749	0.0
chol(326)	0.006134969325153374	0.0
chol(328)	0.006134969325153374	0.0
chol(329)	0.0	0.01020408163265306
chol(331)	0.0	0.01020408163265306
chol(336)	0.0	0.01020408163265306
chol(338)	0.0	0.01020408163265306
chol(339)	0.006134969325153374	0.0
chol(340)	0.006134969325153374	0.0
chol(341)	0.0	0.02040816326530612
chol(342)	0.0	0.02040816326530612
chol(344)	0.006134969325153374	0.0
chol(347)	0.006134969325153374	0.0
chol(355)	0.0	0.01020408163265306
chol(358)	0.006134969325153374	0.0
chol(365)	0.006134969325153374	0.0
chol(388)	0.0	0.01020408163265306
chol(392)	0.0	0.01020408163265306
chol(393)	0.0	0.01020408163265306
aba1/20/1	0 006124060206162274	0 0

CHOT (994)	U.UU01347073231333/4	U.U
chol(404)	0.0	0.01020408163265306
chol(412)	0.006134969325153374	0.0
chol(466)	0.0	0.0
chol(468)	0.0	0.0
chol(491)	0.0	0.01020408163265306
chol(518)	0.0	0.01020408163265306
chol(529)	0.0	0.01020408163265306
chol(603)	0.0	0.01020408163265306
chol(85)	0.006134969325153374	0.0

### In [34]:

```
print(model.get_cpds('sex'))
```

sex(0)	0.264368
sex(1)	0.735632

#### In [35]:

```
model.get_independencies()
```

### Out[35]:

```
(age _{-}|_ sex, exang)
(age _|_ exang | sex)
     _|_ chol, thalach, restecg | heartdisease)
(age _{-}|_ sex, exang | fbs)
(age _|_ sex | exang)
(age _{-}|_ chol, thalach, restecg | sex, heartdisease)
(age \_|\_ exang | sex, fbs)
(age _|_ thalach, restecg | chol, heartdisease)
     _|_ chol, restecg | heartdisease, thalach)
(age _{-}|_ chol, thalach | heartdisease, restecg)
(age _|_ chol, thalach, restecg | heartdisease, trestbps)
(age _{-}|_ chol, thalach, restecg | heartdisease, fbs)
(age _|_ chol, thalach, restecg | heartdisease, exang)
     _|_ heartdisease, thalach, restecg, chol | fbs, trestbps)
(age _{-}| sex | fbs, exang)
(age _|_ thalach, restecg | sex, chol, heartdisease)
(age _|_ chol, restecg | sex, heartdisease, thalach)
(age _{-} chol, thalach | sex, heartdisease, restecg)
(age _{-}|_ chol, thalach, restecg | sex, heartdisease, trestbps)
(age _{-}|_ chol, thalach, restecg | sex, heartdisease, fbs)
(age _{-}|_ chol, thalach, restecg | sex, heartdisease, exang)
(age _|_ heartdisease, thalach, restecg, chol | sex, fbs, trestbps)
(age _{-}|_ restecg | chol, thalach, heartdisease)
(age _|_ thalach | chol, restecg, heartdisease)
(age _{-}|_ thalach, restecg | trestbps, chol, heartdisease)
(age _|_ thalach, restecg | chol, fbs, heartdisease)
(age _|_ thalach, restecg | exang, chol, heartdisease)
(age _|_ heartdisease, thalach, restecg | chol, fbs, trestbps)
(age \_|\_ chol | heartdisease, thalach, restecg)
     _|_ chol, restecg | heartdisease, thalach, trestbps)
(age \_|\_ chol, restecg | heartdisease, thalach, fbs)
(age _|_ chol, restecg | heartdisease, thalach, examg)
(age _|_ chol, thalach | heartdisease, restecg, trestbps)
(age \_|\_ chol, thalach | heartdisease, restecg, fbs)
(age \_|\_ chol, thalach | heartdisease, restecg, exang)
(age _|_ chol, thalach, restecg | heartdisease, fbs, trestbps)
(age _|_ chol, thalach, restecg | exang, heartdisease, trestbps)
(age | chol, thalach, restecg | exang, heartdisease, fbs)
```

```
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(trestbps \_|\_ chol, thalach, restecg | sex, heartdisease, fbs, age)
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 ({\tt trestbps} \ \_| \ \_ \ {\tt restecg} \ | \ {\tt exang}, \ {\tt chol}, \ {\tt thalach}, \ {\tt heartdisease}) 
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 (\texttt{trestbps} \ \_| \ \_ \ \texttt{restecg} \ | \ \texttt{sex}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{chol}, \ \texttt{exang}) 
(trestbps _|_ restecg | sex, exang, heartdisease, thalach, chol, fbs)
 ({\tt trestbps} \ \_| \ \_ \ {\tt thalach} \ | \ {\tt sex, heartdisease, age, restecg, chol, fbs}) 
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(trestbps \_|\_ thalach | sex, exang, heartdisease, age, restecg, chol, fbs)
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(fbs _{-}|_ sex, thalach, exang, restecg | trestbps, chol, age, heartdisease)
(fbs _{-}|_ thalach, restecg | exang, chol, age, heartdisease)
(fbs _{-}|_ thalach | trestbps, chol, restecg, heartdisease)
(fbs _|_ thalach | exang, chol, restecg, heartdisease)
     _|_ thalach, restecg | trestbps, exang, chol, heartdisease)
(fbs _|_ sex, exang | trestbps, chol, thalach, age)
(fbs _|_ sex, exang | trestbps, chol, restecg, age)
(fbs _{-}|_ sex | trestbps, exang, chol, age)
(fbs _{-}|_ chol | restecg, heartdisease, thalach, age)
(fbs \_|\_ sex, chol, restecg, exang | trestbps, heartdisease, thalach, age)
     _|_ chol, restecg | exang, heartdisease, thalach, age)
(fbs
     _|_ chol | trestbps, heartdisease, thalach, restecg)
(fbs _{-}|_ chol | exang, heartdisease, thalach, restecg)
(fbs _{-}|_ chol, restecg | exang, heartdisease, thalach, trestbps)
(fbs _{-}|_ sex, chol, thalach, exang | trestbps, heartdisease, restecg, age)
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(IDS _|_ CHOI, CHAIACH | EMANY, HEALCUIDEASE, LESCECY, AYE)
     _{\rm I} sex, chol, thalach, restecg | trestbps, exang, heartdisease, age)
     _|_ chol, thalach | exang, heartdisease, restecg, trestbps)
(fbs _|_ sex, exang | restecg, thalach, age, trestbps)
(fbs _{-}|_ sex | trestbps, exang, thalach, age)
(fbs _|_ sex | trestbps, exang, restecg, age)
     _|_ restecg | sex, heartdisease, thalach, age, chol)
     _|_ restecg | sex, heartdisease, thalach, trestbps, chol)
(fbs
     _|_ restecg | sex, heartdisease, thalach, chol, exang)
(fbs _{-}|_ thalach | sex, heartdisease, age, restecg, chol)
(fbs \_|\_ restecg, thalach, exang | sex, heartdisease, age, trestbps, chol)
(fbs _|_ thalach, restecg | sex, heartdisease, age, chol, exang)
     _|_ thalach | sex, heartdisease, restecg, trestbps, chol)
     _|_ thalach | sex, heartdisease, restecg, chol, exang)
(fbs
(fbs _{-}|_ restecg, thalach | sex, heartdisease, trestbps, chol, exang)
(fbs _{-}|_ exang | sex, thalach, age, trestbps, chol)
(fbs _ | _ exang | sex, age, restecg, trestbps, chol)
     _|_ chol | sex, heartdisease, thalach, age, restecg)
(fbs _{-} chol, restecg, exang | sex, heartdisease, thalach, age, trestbps)
(fbs _|_ chol, restecg | sex, heartdisease, thalach, age, exang)
(fbs _{-}|_ chol | sex, heartdisease, thalach, restecg, trestbps)
(fbs _|_ chol | sex, heartdisease, thalach, restecg, exang)
(fbs _|_ chol, restecg | sex, heartdisease, thalach, trestbps, exang)
     _|_ chol, thalach, exang | sex, heartdisease, age, restecg, trestbps)
     _|_ chol, thalach | sex, heartdisease, age, restecg, exang)
(fbs _|_ chol, thalach, restecg | sex, heartdisease, age, trestbps, exang)
(fbs \_|\_ chol, thalach | sex, heartdisease, restecg, trestbps, exang)
(fbs _|_ exang | sex, thalach, age, restecg, trestbps)
     _|_ sex, restecg, exang | heartdisease, thalach, age, trestbps, chol)
     _|_ restecg | heartdisease, thalach, age, chol, exang)
(fbs
     _|_ restecg | heartdisease, thalach, trestbps, chol, exang)
(fbs _{-}|_ sex, thalach, exang | heartdisease, age, restecg, trestbps, chol)
(fbs _|_ thalach | heartdisease, age, restecg, chol, exang)
(fbs _{-}|_ sex, thalach, restecg | heartdisease, age, trestbps, chol, exang)
     _|_ thalach | heartdisease, restecg, trestbps, chol, exang)
     _|_ sex, exang | thalach, age, restecg, trestbps, chol)
(fbs _|_ sex | thalach, age, trestbps, chol, exang)
(fbs _{-}|_ sex | age, restecg, trestbps, chol, exang)
(fbs _{-}|_ sex, chol, exang | heartdisease, thalach, age, restecg, trestbps)
     _|_ chol | heartdisease, thalach, age, restecg, exang)
(fbs
     _|_ sex, chol, restecg | heartdisease, thalach, age, trestbps, exang)
     _|_ chol | heartdisease, thalach, restecg, trestbps, exang)
(fbs _{-}|_ sex, chol, thalach | heartdisease, age, restecg, trestbps, exang)
(fbs \_|\_ sex | thalach, age, restecg, trestbps, exang)
(fbs _|_ restecg, exang | sex, heartdisease, thalach, age, trestbps, chol)
     _|_ restecg | sex, heartdisease, thalach, age, chol, exang)
     _|_ restecg | sex, heartdisease, thalach, trestbps, chol, exang)
(fbs _|_ thalach, exang | sex, heartdisease, age, restecg, trestbps, chol)
(fbs _|_ thalach | sex, heartdisease, age, restecg, chol, exang)
(fbs _{-}|_ thalach, restecg | sex, heartdisease, age, trestbps, chol, exang)
(fbs _{-}|_ thalach | sex, heartdisease, restecg, trestbps, chol, exang)
(fbs _|_ exang | sex, thalach, age, restecg, trestbps, chol)
(fbs _|_ chol, exang | sex, heartdisease, thalach, age, restecg, trestbps)
(fbs _|_ chol | sex, heartdisease, thalach, age, restecg, exang)
(fbs _{-} chol, restecg | sex, heartdisease, thalach, age, trestbps, exang)
(fbs _|_ chol | sex, heartdisease, thalach, restecg, trestbps, exang)
     _|_ chol, thalach | sex, heartdisease, age, restecg, trestbps, exang)
     _|_ sex, exang | heartdisease, thalach, age, restecg, trestbps, chol)
(fbs _{-}|_ sex, restecg | heartdisease, thalach, age, trestbps, chol, exang)
(fbs _{-}|_ sex, thalach | heartdisease, age, restecg, trestbps, chol, exang)
(fbs _{-}|_ sex | thalach, age, restecg, trestbps, chol, exang)
(fbs \_|\_ sex, chol | heartdisease, thalach, age, restecg, trestbps, exang)
(fbs
     _|_ exang | sex, heartdisease, thalach, age, restecg, trestbps, chol)
(fbs _|_ restecg | sex, heartdisease, thalach, age, trestbps, chol, exang)
(fbs _{-}|_ thalach | sex, heartdisease, age, restecg, trestbps, chol, exang)
(fbs _{-} chol | sex, heartdisease, thalach, age, restecg, trestbps, exang)
(fbs _|_ sex | heartdisease, thalach, age, restecg, trestbps, chol, exang)
(sex _{-}|_ age, fbs, exang)
(sex _|_ chol, thalach, restecg | heartdisease)
(sex _|_ fbs, exang | age)
(sex _{-}|_ age, exang | fbs)
(sex _{-}|_ fbs, age | exang)
(sex _|_ thalach, restecg | chol, heartdisease)
     _|_ chol, restecg | heartdisease, thalach)
(sex _|_ chol, thalach, restecg | heartdisease, age)
(sex _{-}|_ chol, thalach | heartdisease, restecg)
(sex _|_ chol, thalach, restecg | heartdisease, trestbps)
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(sex _|_ choi, thatach, restecg | heartcasease, ibs)
      _|_ chol, thalach, restecg | heartdisease, exang)
(sex _
(sex _{-}|_ fbs, restecg, chol, thalach, heartdisease | trestbps, age)
(sex _|_ exang | fbs, age)
(sex _|_ fbs | exang, age)
(sex _|_ heartdisease, thalach, restecg, chol | fbs, trestbps)
(sex _{-}|_ age | fbs, exang)
(sex _|_ restecg | chol, thalach, heartdisease)
(sex _|_ thalach, restecg | chol, age, heartdisease)
(sex _|_ thalach | chol, restecg, heartdisease)
(sex _|_ thalach, restecg | trestbps, chol, heartdisease)
(sex _|_ thalach, restecg | chol, fbs, heartdisease)
(sex _| thalach, restecg | exang, chol, heartdisease)
     _|_ heartdisease, fbs, thalach, restecg | trestbps, chol, age)
     _|_ heartdisease, thalach, restecg | chol, fbs, trestbps)
(sex _{-}|_ chol, restecg | heartdisease, thalach, age)
(sex _|_ chol | heartdisease, thalach, restecg)
(sex \_|\_ chol, restecg | heartdisease, thalach, trestbps)
     _|_ chol, restecg | heartdisease, thalach, fbs)
(sex _{-}|_ chol, restecg | heartdisease, thalach, exang)
(sex _|_ chol, thalach | heartdisease, restecg, age)
(sex _{-}|_ fbs, thalach, restecg, chol | trestbps, heartdisease, age)
(sex \_|\_ chol, thalach, restecg | heartdisease, fbs, age)
(sex _
      _|_ chol, thalach, restecg | exang, heartdisease, age)
     _|_ chol, thalach | heartdisease, restecg, trestbps)
(sex _|_ chol, thalach | heartdisease, restecg, fbs)
(sex _|_ chol, thalach | heartdisease, restecg, exang)
(sex _{-}|_ chol, thalach, restecg | heartdisease, fbs, trestbps)
(sex _|_ chol, thalach, restecg | exang, heartdisease, trestbps)
(sex _|_ chol, thalach, restecg | exang, heartdisease, fbs)
(sex _|_ heartdisease, restecg, fbs, chol | trestbps, thalach, age)
(sex _|_ heartdisease, restecg, chol | fbs, thalach, trestbps)
(sex _|_ heartdisease, thalach, fbs, chol | trestbps, restecg, age)
(sex _{-}|_ heartdisease, thalach, restecg, chol | trestbps, fbs, age)
(sex _{-}|_ fbs, restecg, chol, thalach, heartdisease | trestbps, exang, age)
(sex \_|\_ heartdisease, thalach, chol | fbs, restecg, trestbps)
(sex _|_ heartdisease, thalach, restecg, chol | exang, fbs, trestbps)
(sex _|_ restecg | chol, age, thalach, heartdisease)
(sex _|_ restecg | trestbps, chol, thalach, heartdisease)
(\texttt{sex} \ \_| \ \_ \ \texttt{restecg} \ | \ \texttt{chol}, \ \texttt{fbs}, \ \texttt{thalach}, \ \texttt{heartdisease})
      _|_ restecg | exang, chol, thalach, heartdisease)
(\verb"sex _|\_ that ach | chol, age, restecg, heart disease)
(sex _{-}|_ fbs, thalach, restecg | trestbps, chol, age, heartdisease)
(sex \_|\_ thalach, restecg | chol, age, heartdisease, fbs)
(sex _{-}|_ thalach, restecg | exang, chol, age, heartdisease)
(sex _|_ thalach | trestbps, chol, restecg, heartdisease)
(sex _|_ thalach | chol, fbs, restecg, heartdisease)
(sex _|_ thalach | exang, chol, restecg, heartdisease)
(sex _|_ restecg, thalach | trestbps, chol, fbs, heartdisease)
(\texttt{sex} \_|\_ \texttt{restecg, thalach} \mid \texttt{trestbps, exang, chol, heartdisease})
(sex _{-}|_ restecg, thalach | exang, chol, fbs, heartdisease)
(sex _{-}|_ heartdisease, restecg, fbs | trestbps, chol, thalach, age)
(sex \_|\_ heartdisease, restecg | chol, fbs, thalach, trestbps)
(sex _|_ heartdisease, thalach, fbs | trestbps, chol, restecg, age)
(sex _{-}|_ heartdisease, thalach, restecg | trestbps, chol, fbs, age)
(\texttt{sex} \ \_| \ \_ \ \texttt{restecg, heartdisease, thalach, fbs} \ | \ \texttt{trestbps, exang, chol, age})
      |_ heartdisease, thalach | chol, fbs, restecg, trestbps)
(sex _
     _|_ heartdisease, restecg, thalach | exang, chol, fbs, trestbps)
     _|_ chol | restecg, heartdisease, thalach, age)
(sex _{-}|_ chol, restecg, fbs | trestbps, heartdisease, thalach, age)
(sex _|_ chol, restecg | heartdisease, fbs, thalach, age)
(sex _|_ chol, restecg | exang, heartdisease, thalach, age)
     _|_ chol | trestbps, heartdisease, thalach, restecg)
(sex _{-}|_ chol | heartdisease, fbs, thalach, restecg)
(sex _|_ chol | exang, heartdisease, thalach, restecg)
(sex _|_ chol, restecg | heartdisease, fbs, thalach, trestbps)
(sex _{-}|_ chol, restecg | exang, heartdisease, thalach, trestbps)
     _|_ chol, restecg | exang, heartdisease, thalach, fbs)
     _|_ chol, thalach, fbs | trestbps, heartdisease, restecg, age)
(sex _|_ chol, thalach | heartdisease, fbs, restecg, age)
(sex _|_ chol, thalach | exang, heartdisease, restecg, age)
(sex _|_ chol, thalach, restecg | trestbps, heartdisease, fbs, age)
(sex _{-}|_ restecg, chol, thalach, fbs | trestbps, exang, heartdisease, age)
      _|_ chol, thalach, restecg | exang, heartdisease, fbs, age)
     _|_ chol, thalach | heartdisease, fbs, restecg, trestbps)
(sex
(sex _|_ chol, thalach | exang, heartdisease, restecg, trestbps)
(sex _{-}|_ chol, thalach | exang, heartdisease, restecg, fbs)
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(sex _{-}|_ cno1, restecg, tna1acn | exang, neartalsease, ibs, trestbps)
(sex _|_ heartdisease, chol, fbs | restecg, thalach, age, trestbps)
      _|_ chol, restecg, heartdisease | trestbps, fbs, thalach, age)
(sex _{-}|_ heartdisease, chol, restecg, fbs | trestbps, exang, thalach, age)
(sex _{-}|_ chol, heartdisease | trestbps, fbs, thalach, restecg)
(\texttt{sex} \_|\_\texttt{chol}, \texttt{restecg}, \texttt{heartdisease} \mid \texttt{exang}, \texttt{fbs}, \texttt{thalach}, \texttt{trestbps})
(sex _{-}|_ chol, thalach, heartdisease | trestbps, fbs, restecg, age)
(sex _|_ heartdisease, chol, thalach, fbs | trestbps, exang, restecg, age)
(sex _{-}|_ chol, restecg, heartdisease, thalach | trestbps, exang, fbs, age)
(sex _{-}|_ chol, thalach, heartdisease | examg, fbs, restecg, trestbps)
(sex _|_ fbs, restecg | heartdisease, thalach, age, trestbps, chol)
(sex _{-}|_ restecg | heartdisease, thalach, age, chol, fbs)
(sex _{-}|_ restecg | heartdisease, thalach, age, chol, exang)
(sex _{-}|_ restecg | heartdisease, thalach, trestbps, chol, fbs)
(sex _|_ restecg | heartdisease, thalach, trestbps, chol, exang)
(sex _|_ restecg | heartdisease, thalach, fbs, chol, exang)
(sex _{-}|_ fbs, thalach | heartdisease, age, restecg, trestbps, chol)
(sex _{-}|_ thalach | heartdisease, age, restecg, chol, fbs)
(sex _{-}|_ thalach | heartdisease, age, restecg, chol, exang)
      _{-}|_ thalach, restecg | heartdisease, age, trestbps, chol, fbs)
(sex _{-}|_ fbs, thalach, restecg | heartdisease, age, trestbps, chol, exang)
(sex _{-}|_ thalach, restecg | heartdisease, age, fbs, chol, exang)
(sex _|_ thalach | heartdisease, restecg, trestbps, chol, fbs)
(\texttt{sex} \ \_| \ \_ \ \texttt{thalach} \ | \ \texttt{heartdisease}, \ \texttt{restecg}, \ \texttt{trestbps}, \ \texttt{chol}, \ \texttt{exang})
(sex _|_ thalach | heartdisease, fbs, restecg, chol, exang)
(sex _{-}|_ restecg, thalach | heartdisease, fbs, trestbps, chol, exang)
(sex _|_ heartdisease, fbs | thalach, age, restecg, trestbps, chol)
(sex _|_ heartdisease, restecg | thalach, age, trestbps, chol, fbs)
(sex _{-}|_ heartdisease, restecg, fbs | thalach, age, trestbps, chol, exang)
(sex _|_ heartdisease | thalach, restecg, trestbps, chol, fbs)
(sex _|_ heartdisease, restecg | thalach, fbs, trestbps, chol, exang)
(sex _{-}|_ heartdisease, thalach | age, restecg, trestbps, chol, fbs)
(sex _{-}|_ heartdisease, thalach, fbs | age, restecg, trestbps, chol, exang)
(sex _{-}|_ heartdisease, thalach, restecg | age, fbs, trestbps, chol, exang)
(sex _|_ heartdisease, thalach | fbs, restecg, trestbps, chol, exang)
(sex _|_ chol, fbs | heartdisease, thalach, age, restecg, trestbps)
(sex _|_ chol | heartdisease, thalach, age, restecg, fbs)
(sex _|_ chol | heartdisease, thalach, age, restecg, exang)
(sex _{-}|_ chol, restecg | heartdisease, thalach, age, trestbps, fbs)
(sex _{-}|_ chol, restecg, fbs | heartdisease, thalach, age, trestbps, exang)
(sex _|_ chol, restecg | heartdisease, thalach, age, fbs, exang)
      _|_ chol | heartdisease, thalach, restecg, trestbps, fbs)
      _{-}|_ chol | heartdisease, thalach, restecg, trestbps, exang)
(sex
(sex _{-}|_ chol | heartdisease, thalach, restecg, fbs, exang)
(\texttt{sex} \ \_| \ \_ \ \texttt{chol}, \ \texttt{restecg} \ | \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{trestbps}, \ \texttt{fbs}, \ \texttt{exang})
(sex _|_ chol, thalach | heartdisease, age, restecg, trestbps, fbs)
      _|_ chol, thalach, fbs | heartdisease, age, restecg, trestbps, exang)
(sex _{-}|_ chol, thalach | heartdisease, age, restecg, fbs, exang)
(sex _|_ chol, thalach, restecg | heartdisease, age, trestbps, fbs, exang)
(sex _{-}|_ chol, thalach | heartdisease, restecg, trestbps, fbs, exang)
(sex _{-}|_ chol, heartdisease | thalach, age, restecg, trestbps, fbs)
(sex _|_ heartdisease, chol, fbs | thalach, age, restecg, trestbps, exang)
      _|_ chol, restecg, heartdisease | thalach, age, trestbps, fbs, exang)
(sex _{-}|_ chol, heartdisease | thalach, restecg, trestbps, fbs, exang)
(\texttt{sex} \_|\_\texttt{chol}, \texttt{thalach}, \texttt{heartdisease} \mid \texttt{age}, \texttt{restecg}, \texttt{trestbps}, \texttt{fbs}, \texttt{exang})
(sex _ | _ fbs | heartdisease, thalach, age, restecg, trestbps, chol)
(sex _|_ restecg | heartdisease, thalach, age, trestbps, chol, fbs)
      _|_ fbs, restecg | heartdisease, thalach, age, trestbps, chol, exang)
(\text{sex }\_|\_\text{ restecg }|\ \text{exang, heartdisease, thalach, age, chol, fbs})
(sex _|_ restecg | exang, heartdisease, thalach, trestbps, chol, fbs)
(sex _|_ thalach | heartdisease, age, restecg, trestbps, chol, fbs)
(sex _{-}|_ fbs, thalach | heartdisease, age, restecg, trestbps, chol, exang)
(sex _|_ thalach | exang, heartdisease, age, restecg, chol, fbs)
(\text{sex \_|\_} \text{thalach, restecg} \mid \text{exang, heartdisease, age, trestbps, chol, fbs})
(sex _|_ thalach | exang, heartdisease, restecg, trestbps, chol, fbs)
(sex _|_ heartdisease | thalach, age, restecg, trestbps, chol, fbs)
(sex _{-}|_ heartdisease, fbs | thalach, age, restecg, trestbps, chol, exang)
(\texttt{sex} \_|\_ \texttt{heartdisease}, \ \texttt{restecg} \ | \ \texttt{exang}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{chol}, \ \texttt{fbs})
(\texttt{sex} \_|\_ \texttt{heartdisease} \mid \texttt{exang, thalach, restecg, trestbps, chol, fbs})
(sex _ | _ heartdisease, thalach | exang, age, restecg, trestbps, chol, fbs)
(sex _|_ chol | heartdisease, thalach, age, restecg, trestbps, fbs)
(sex _{-}|_ chol, fbs | heartdisease, thalach, age, restecg, trestbps, exang)
(sex _{-}|_ chol | heartdisease, thalach, age, restecg, fbs, exang)
      _{-} chol, restecg | heartdisease, thalach, age, trestbps, fbs, exang)
      _|_ chol | heartdisease, thalach, restecg, trestbps, fbs, exang)
      _|_ chol, thalach | heartdisease, age, restecg, trestbps, fbs, exang)
(sex
(\texttt{sex} \_|\_\texttt{chol}, \texttt{heartdisease} \mid \texttt{thalach}, \texttt{age}, \texttt{restecg}, \texttt{trestbps}, \texttt{fbs}, \texttt{exang})
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(sex _|_ ibs | heartdisease, thalach, age, restecg, trestbps, chol, exang)
(sex _|_ restecg | exang, heartdisease, thalach, age, trestbps, chol, fbs)
(sex _|_ thalach | exang, heartdisease, age, restecg, trestbps, chol, fbs)
     _|_ heartdisease | exang, thalach, age, restecg, trestbps, chol, fbs)
     _|_ chol | heartdisease, thalach, age, restecg, trestbps, fbs, exang)
(exang _|_ sex, fbs, age)
(exang \_|\_ fbs, age | sex)
(exang _{-} chol, thalach, restecg | heartdisease)
(exang _{-}| sex, fbs | age)
(exang _|_ sex, age | fbs)
(exang _{-}|_ chol, thalach, restecg | sex, heartdisease)
(exang \_|\_ fbs | sex, age)
(exang _|_ age | sex, fbs)
(exang _{-}|_ thalach, restecg | chol, heartdisease)
(exang _{-}|_ chol, restecg | heartdisease, thalach)
(exang _|_ chol, thalach, restecg | heartdisease, age)
(exang \_|\_ chol, thalach | heartdisease, restecg)
(exang \_|\_ chol, thalach, restecg | heartdisease, trestbps)
(exang \_|\_ chol, thalach, restecg | heartdisease, fbs)
(exang _{-}|_ fbs, restecg, chol, thalach, heartdisease | trestbps, age)
(exang _{-}| sex | fbs, age)
(exang _|_ heartdisease, thalach, restecg, chol | fbs, trestbps)
(exang _|_ thalach, restecg | sex, chol, heartdisease)
(exang \_|\_ chol, restecg | sex, heartdisease, thalach)
(exang _{-}|_ chol, thalach, restecg | sex, heartdisease, age)
(exang _|_ chol, thalach | sex, heartdisease, restecg)
(exang _|_ chol, thalach, restecg | sex, heartdisease, trestbps)
(exang \_|\_ chol, thalach, restecg | sex, heartdisease, fbs)
(exang _|_ fbs, restecg, chol, thalach, heartdisease | sex, age, trestbps)
(exang _|_ heartdisease, thalach, restecg, chol | sex, fbs, trestbps)
(exang \_|\_ restecg | chol, thalach, heartdisease)
(exang _{-}|_ thalach, restecg | chol, age, heartdisease)
(exang _{-}|_ thalach | chol, restecg, heartdisease)
(exang _{-}|_ thalach, restecg | trestbps, chol, heartdisease)
(exang \_|\_ thalach, restecg | chol, fbs, heartdisease)
(exang \_|\_ heartdisease, fbs, thalach, restecg | trestbps, chol, age)
(exang _|_ heartdisease, thalach, restecg | chol, fbs, trestbps)
(exang _|_ chol, restecg | heartdisease, thalach, age)
(exang \_|\_ chol | heartdisease, thalach, restecg)
(exang \_|\_ chol, restecg | heartdisease, thalach, trestbps)
(exang \_|\_ chol, restecg | heartdisease, thalach, fbs)
(exang _{-} chol, thalach | heartdisease, restecg, age)
(exang _| _ chol, fbs, thalach, restecg | trestbps, heartdisease, age)
(exang _|_ chol, thalach, restecg | heartdisease, fbs, age)
(exang _{-}|_ chol, thalach | heartdisease, restecg, trestbps)
(exang \_|\_ chol, thalach | heartdisease, restecg, fbs)
(exang _{-}|_ chol, thalach, restecg | heartdisease, fbs, trestbps)
(exang \_|\_ heartdisease, restecg, fbs, chol | trestbps, thalach, age)
(exang \_|\_ heartdisease, restecg, chol | fbs, thalach, trestbps)
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(heartdisease \_|\_ exang | sex, thalach, age, trestbps, chol, fbs)
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(restecg _
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(restecg _|_ chol, age, thalach, trestbps | sex, exang, heartdisease, fbs)
(restecg \_|\_ exang | sex, thalach, age, trestbps)
(restecg _|_ age, exang | sex, fbs, thalach, trestbps)
(restecg _|_ = exang | sex, fbs, age, trestbps)
(restecg \_|\_ age | sex, exang, fbs, trestbps)
(restecg _|_ sex, fbs, exang, trestbps | chol, age, thalach, heartdisease)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex, fbs, age, exang} \ | \ \texttt{trestbps, chol, thalach, heartdisease})
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{age}, \ \texttt{exang}, \ \texttt{trestbps} \ | \ \texttt{chol}, \ \texttt{fbs}, \ \texttt{thalach}, \ \texttt{heartdisease})
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{fbs}, \ \texttt{age}, \ \texttt{trestbps} \ | \ \texttt{exang}, \ \texttt{chol}, \ \texttt{thalach}, \ \texttt{heartdisease})
            _{\rm -}|_{\rm -} sex, fbs, thalach, exang | trestbps, chol, age, heartdisease)
(restecg _|_ sex, thalach, exang, trestbps | chol, age, heartdisease, fbs)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{fbs}, \ \texttt{thalach}, \ \texttt{trestbps} \ | \ \texttt{exang}, \ \texttt{chol}, \ \texttt{age}, \ \texttt{heartdisease})
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{age}, \ \texttt{thalach}, \ \texttt{exang} \ | \ \texttt{trestbps}, \ \texttt{chol}, \ \texttt{fbs}, \ \texttt{heartdisease})
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{fbs}, \ \texttt{thalach}, \ \texttt{age} \ | \ \texttt{trestbps}, \ \texttt{exang}, \ \texttt{chol}, \ \texttt{heartdisease})
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{trestbps} \ | \ \texttt{exang}, \ \texttt{chol}, \ \texttt{fbs}, \ \texttt{heartdisease})
(restecg \_|\_ sex, exang | trestbps, chol, thalach, age)
(restecg _{-}|_ sex, age, exang | chol, fbs, thalach, trestbps)
(restecg \_|\_ sex, exang | trestbps, chol, fbs, age)
(restecg _|_ sex | trestbps, exang, chol, age)
(restecg \_|\_ sex, age | exang, chol, fbs, trestbps)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{chol}, \ \texttt{fbs}, \ \texttt{exang} \ | \ \texttt{trestbps}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{age})
(restecg _|_ sex, chol, exang, trestbps | heartdisease, fbs, thalach, age)
(restecg _|_ sex, chol, fbs, trestbps | exang, heartdisease, thalach, age)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{chol}, \ \texttt{age}, \ \texttt{exang} \ | \ \texttt{heartdisease}, \ \texttt{fbs}, \ \texttt{thalach}, \ \texttt{trestbps})
(restecg _|_ sex, chol, age, fbs | exang, heartdisease, thalach, trestbps)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{chol}, \ \texttt{age}, \ \texttt{trestbps} \ | \ \texttt{exang}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{fbs})
(restecg _|_ sex, chol, thalach, exang | trestbps, heartdisease, fbs, age)
(restecg _|_ sex, chol, thalach, fbs | trestbps, exang, heartdisease, age)
(restecg _{-}|_ sex, chol, thalach, trestbps | exang, heartdisease, fbs, age)
(restecg _|_ sex, chol, thalach, age | exang, heartdisease, fbs, trestbps)
(restecg _|_ sex, exang | trestbps, fbs, thalach, age)
(restecg \_|\_ sex | trestbps, exang, thalach, age)
            _|_ sex, age | exang, fbs, thalach, trestbps)
(resteca
(restecg \_|\_ sex | trestbps, exang, fbs, age)
(\texttt{restecg} \ \_| \ \_ \ \texttt{trestbps}, \ \texttt{fbs}, \ \texttt{exang} \ | \ \texttt{sex}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{chol})
(restecg _|_ fbs, age, exang | sex, heartdisease, thalach, trestbps, chol)
(restecg _|_ exang, age, trestbps | sex, heartdisease, thalach, chol, fbs)
(\texttt{restecg} \ \_| \ \_ \ \texttt{fbs, age, trestbps} \ | \ \texttt{sex, heartdisease, thalach, chol, exang})
(restecg _ | _ fbs, thalach, exang | sex, heartdisease, age, trestbps, chol)
(restecg _{-}|_ trestbps, thalach, exang | sex, heartdisease, age, chol, fbs)
(\texttt{restecg} \ \_| \ \_ \ \texttt{fbs, thalach, trestbps} \ | \ \texttt{sex, heartdisease, age, chol, exang})
(restecg _|_ age, thalach, exang | sex, heartdisease, trestbps, chol, fbs)
            _{-}|_ fbs, thalach, age | sex, heartdisease, trestbps, chol, exang)
(restecg _| age, thalach, trestbps | sex, heartdisease, fbs, chol, exang)
(\texttt{restecg} \ \_| \ \_ \ \texttt{exang} \ | \ \texttt{sex, thalach, age, trestbps, chol})
(restecg \_|\_ age, exang | sex, thalach, trestbps, chol, fbs)
(restecg _|_ exang | sex, age, trestbps, chol, fbs)
            _|_ age | sex, fbs, trestbps, chol, exang)
(restecg _|_ chol, fbs, exang | sex, heartdisease, thalach, age, trestbps)
(restecg _| trestbps, chol, exang | sex, heartdisease, thalach, age, fbs)
(restecg _|_ trestbps, chol, fbs | sex, heartdisease, thalach, age, exang)
(restecg _|_ chol, age, exang | sex, heartdisease, thalach, trestbps, fbs)
(restecg _|_ chol, age, fbs | sex, heartdisease, thalach, trestbps, exang)
(\texttt{restecg} \ \_| \ \_ \ \texttt{chol}, \ \texttt{age}, \ \texttt{trestbps} \ | \ \texttt{sex}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{fbs}, \ \texttt{exang})
(restecg _|_ chol, thalach, exang | sex, heartdisease, age, trestbps, fbs)
(\texttt{restecg} \ \_| \ \_ \texttt{chol}, \ \texttt{thalach}, \ \texttt{fbs} \ | \ \texttt{sex}, \ \texttt{heartdisease}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{exang})
(restecg _{-} |_{-} chol, thalach, trestbps | sex, heartdisease, age, fbs, exang)
(restecg _|_ chol, thalach, age | sex, heartdisease, trestbps, fbs, exang)
(restecg _{-}|_ exang | sex, thalach, age, trestbps, fbs)
(restecg _|_ age | sex, thalach, trestbps, fbs, exang)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{fbs}, \ \texttt{exang} \ | \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{chol})
(restecg _|_ sex, exang, trestbps | heartdisease, thalach, age, chol, fbs)
(restecg _|_ sex, fbs, trestbps | heartdisease, thalach, age, chol, exang)
(restecg _|_ sex, age, exang | heartdisease, thalach, trestbps, chol, fbs)
(restecg \_|\_ sex, fbs, age | heartdisease, thalach, trestbps, chol, exang)
(restecg _|_ sex, age, trestbps | heartdisease, thalach, fbs, chol, exang)
(restecg \_|\_ sex, thalach, exang | heartdisease, age, trestbps, chol, fbs)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{fbs}, \ \texttt{thalach} \ | \ \texttt{heartdisease}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{chol}, \ \texttt{exang})
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{thalach}, \ \texttt{trestbps} \ | \ \texttt{heartdisease}, \ \texttt{age}, \ \texttt{fbs}, \ \texttt{chol}, \ \texttt{exang})
(restecg \_|\_ sex, thalach, age | heartdisease, fbs, trestbps, chol, exang)
(restecg _|_ sex, exang | thalach, age, trestbps, chol, fbs)
(restecg _|_ sex | thalach, age, trestbps, chol, exang)
(restecg _|_ sex, age | thalach, fbs, trestbps, chol, exang)
(restecg \_|\_ sex | age, fbs, trestbps, chol, exang)
(restecg | sex, chol, exang | heartdisease, thalach, age, trestbps, fbs)
```

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_{-}|_ sex, chol, fbs | heartdisease, thalach, age, trestbps, exang)
(restecg
(restecg _{-}|_ sex, chol, trestbps | heartdisease, thalach, age, fbs, exang)
(restecg _| sex, chol, age | heartdisease, thalach, trestbps, fbs, exang)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{chol}, \ \texttt{thalach} \ | \ \texttt{heartdisease}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{fbs}, \ \texttt{exang})
(restecg \_|\_ sex | thalach, age, trestbps, fbs, exang)
(\texttt{restecg} \ \_| \ \_ \ \texttt{fbs, exang} \ | \ \texttt{sex, heartdisease, thalach, age, trestbps, chol})
            _|_ trestbps, exang | sex, heartdisease, thalach, age, chol, fbs)
(restecg _|_ fbs, trestbps | sex, heartdisease, thalach, age, chol, exang)
(restecg \_|\_ age, exang | sex, heartdisease, thalach, trestbps, chol, fbs)
(restecg _{-}|_ fbs, age | sex, heartdisease, thalach, trestbps, chol, exang)
(restecg _|_ age, trestbps | sex, exang, heartdisease, thalach, chol, fbs)
(\texttt{restecg} \ \_| \ \_ \ \texttt{thalach}, \ \texttt{exang} \ | \ \texttt{sex}, \ \texttt{heartdisease}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{chol}, \ \texttt{fbs})
(restecg _{-}|_ fbs, thalach | sex, heartdisease, age, trestbps, chol, exang)
(restecg _| thalach, trestbps | sex, exang, heartdisease, age, chol, fbs)
(restecg _{-} thalach, age | sex, exang, heartdisease, trestbps, chol, fbs)
(restecg \_|\_ exang | sex, thalach, age, trestbps, chol, fbs)
(restecg _{-}|_ age | sex, exang, thalach, trestbps, chol, fbs)
(\texttt{restecg} \ \_| \ \_ \ \texttt{chol}, \ \texttt{exang} \ | \ \texttt{sex}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{fbs})
            _|_ chol, fbs | sex, heartdisease, thalach, age, trestbps, exang)
(restecg _| chol, trestbps | sex, heartdisease, thalach, age, fbs, exang)
(\texttt{restecg} \ \_| \ \_ \ \texttt{chol}, \ \texttt{age} \ | \ \texttt{sex}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{trestbps}, \ \texttt{fbs}, \ \texttt{exang})
(restecg _| chol, thalach | sex, heartdisease, age, trestbps, fbs, exang)
(restecg _|_ sex, exang | heartdisease, thalach, age, trestbps, chol, fbs)
(restecg _{-}|_ sex, fbs | heartdisease, thalach, age, trestbps, chol, exang)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{trestbps} \ | \ \texttt{exang}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{chol}, \ \texttt{fbs})
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{age} \ | \ \texttt{exang}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{trestbps}, \ \texttt{chol}, \ \texttt{fbs})
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{thalach} \ | \ \texttt{exang}, \ \texttt{heartdisease}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{chol}, \ \texttt{fbs})
(restecg _{-}|_ sex | exang, thalach, age, trestbps, chol, fbs)
(\texttt{restecg} \ \_| \ \_ \ \texttt{sex}, \ \texttt{chol} \ | \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{fbs}, \ \texttt{exang})
(restecg _|_ exang | sex, heartdisease, thalach, age, trestbps, chol, fbs)
(restecg _|_ fbs | sex, heartdisease, thalach, age, trestbps, chol, exang)
(\texttt{restecg} \ \_| \ \_ \ \texttt{trestbps} \ | \ \texttt{sex, exang, heartdisease, thalach, age, chol, fbs})
(\texttt{restecg} \ \_| \ \_ \ \texttt{age} \ | \ \texttt{sex}, \ \texttt{exang}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{trestbps}, \ \texttt{chol}, \ \texttt{fbs})
(restecg \_|\_ thalach | sex, exang, heartdisease, age, trestbps, chol, fbs)
(\texttt{restecg} \ \_| \ \_ \ \texttt{chol} \ | \ \texttt{sex}, \ \texttt{heartdisease}, \ \texttt{thalach}, \ \texttt{age}, \ \texttt{trestbps}, \ \texttt{fbs}, \ \texttt{exang})
(restecg _| sex | exang, heartdisease, thalach, age, trestbps, chol, fbs)
(\verb|thalach _|\_| | \verb|sex|, exang, restecg, trestbps, chol, fbs, age | heartdisease)
(\verb|thalach _|\_| = \verb|exang|, \verb|restecg|, \verb|trestbps|, \verb|chol|, \verb|fbs|, \verb|age|| | sex|, \verb|heartdisease|)
(thalach _
            _|_ sex, exang, restecg, trestbps, fbs, age | chol, heartdisease)
            _{-}|_ sex, restecg, trestbps, chol, fbs, exang | heartdisease, age)
(thalach
(thalach _|_ sex, exang, trestbps, chol, fbs, age | heartdisease, restecq)
(\verb|thalach _| \_| \verb|sex|, exang, restecg, chol, fbs, age | heartdisease, trestbps)|
(thalach _ | _ sex, exang, restecg, trestbps, chol, age | heartdisease, fbs)
({\tt thalach}\ \_|\ \_{\tt sex},\ {\tt fbs},\ {\tt restecg},\ {\tt trestbps},\ {\tt chol},\ {\tt age}\ |\ {\tt heartdisease},\ {\tt exang})
(thalach \_|\_ sex, exang | trestbps, age)
(thalach _| \_ sex, exang, age | fbs, trestbps)
(\verb|thalach _|\_| = \verb|exang|, \verb|restecg|, \verb|trestbps|, \verb|fbs|, \verb|age | | sex|, \verb|chol|, \verb|heartdisease|)
(thalach _{-}|_ examg, restecg, trestbps, chol, fbs | sex, heartdisease, age)
(thalach _{-}|_ examg, fbs, trestbps, chol, age | sex, heartdisease, restecg)
(\verb|tha|| ach \_|\_| exang, | fbs, | restecg, | chol, | age | sex, | heartdisease, | trestbps)
({\tt thalach}\ \_|\ \_ \ {\tt exang},\ {\tt restecg},\ {\tt trestbps},\ {\tt chol},\ {\tt age}\ |\ {\tt sex},\ {\tt heartdisease},\ {\tt fbs})
(\verb|thalach _| \_| \verb|fbs|, \verb|restecg|, \verb|trestbps|, \verb|chol|, \verb|age | | sex|, \verb|heartdisease|, exang|)
(thalach _|_ exang | sex, age, trestbps)
(thalach _|_ exang, age | sex, fbs, trestbps)
(\verb|thalach _|\_| \verb|sex|, \verb| restecg|, \verb| trestbps|, \verb| fbs|, \verb| exang | \verb| chol|, \verb| age|, \verb| heartdisease|)
            _|_ sex, exang, trestbps, fbs, age | chol, restecg, heartdisease)
(\verb|thalach _|\_| \verb|sex|, exang, restecg, fbs, age | \verb|trestbps|, chol, heartdisease|)
(\verb|thalach _| \_| \verb|sex|, \verb|exang|, \verb|restecg|, \verb|trestbps|, \verb|age | | \verb|chol|, \verb|fbs|, \verb|heartdisease|)
(\verb|thalach _| \_| \verb|sex|, \verb| restecg|, \verb| trestbps|, \verb| fbs|, \verb| age | exang|, \verb| chol|, \verb| heartdisease|)
(thalach _{-}|_ sex, exang | trestbps, chol, age)
(thalach \_|\_ sex, exang, age | chol, fbs, trestbps)
(thalach _{-}|_ sex, exang, trestbps, chol, fbs | heartdisease, restecg, age)
(thalach _|_ sex, exang, restecg, chol, fbs | trestbps, heartdisease, age)
(thalach _{-} sex, restecg, trestbps, chol, exang | heartdisease, fbs, age)
({\tt thalach}\ \_|\ \_{\tt sex},\ {\tt restecg},\ {\tt trestbps},\ {\tt chol},\ {\tt fbs}\ |\ {\tt exang},\ {\tt heartdisease},\ {\tt age})
(\verb|thalach _| \_| \verb|sex|, exang, fbs, chol, age | heartdisease, restecg, trestbps)|
            _|_ sex, exang, trestbps, chol, age | heartdisease, restecg, fbs)
(thalach _
(thalach _{-}|_ sex, fbs, trestbps, chol, age | heartdisease, restecg, exang)
(thalach _| sex, exang, restecg, chol, age | heartdisease, fbs, trestbps)
(thalach _|_ sex, fbs, restecg, chol, age | exang, heartdisease, trestbps)
(\verb|thalach _|\_| \verb|sex|, \verb| restecg|, \verb| trestbps|, \verb| chol|, \verb| age | | exang|, \verb| heartdisease|, \verb| fbs|)
(thalach _{-}|_ sex, exang | trestbps, restecg, age)
(thalach _{-}|_ sex, exang | trestbps, fbs, age)
(thalach _|_ sex | trestbps, exang, age)
(thalach _|_ sex, exang, age | fbs, restecg, trestbps)
(thalach _|_ sex, age | exang, fbs, trestbps)
(thalach _ | _ trestbps, fbs, restecg, exang | sex, chol, age, heartdisease)
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(\verb|thalach _|\_| = \verb|exang, fbs, age, trestbps | sex, chol, restecg, heartdisease)
           _|_ fbs, age, restecg, exang | sex, chol, heartdisease, trestbps)
(\verb|thalach _| \_| \verb| exang, age, restecg, trestbps | \verb| sex, chol, fbs, heartdisease|)
(\verb|thalach _| \_| \verb|fbs|, age, restecg, trestbps | sex, exang, chol, heartdisease)|\\
(thalach _|_ exang | sex, chol, age, trestbps)
(thalach _{-}|_{-} age, exang | sex, chol, fbs, trestbps)
           _|_ trestbps, chol, fbs, exang | sex, heartdisease, restecg, age)
(\verb|thalach _| \_ | \verb|chol, fbs, restecg, exang | sex, heartdisease, age, trestbps)|
(thalach _|_ trestbps, chol, restecg, exang | sex, heartdisease, fbs, age)
(thalach _| trestbps, chol, restecg, fbs | sex, exang, heartdisease, age)
(\verb|thalach _|\_| chol, fbs, exang, age | sex, heartdisease, restecg, trestbps)|\\
({\tt thalach}\ \_|\ \_ \ {\tt exang},\ {\tt chol},\ {\tt age},\ {\tt trestbps}\ |\ {\tt sex},\ {\tt heartdisease},\ {\tt restecg},\ {\tt fbs})
(thalach _|_ chol, fbs, trestbps, age | sex, heartdisease, restecg, exang)
(\verb|thalach _| \_ | \verb|chol, age, restecg, exang | sex, heartdisease, fbs, trestbps)|
(thalach _|_ chol, age, restecg, fbs | sex, exang, heartdisease, trestbps)
({\tt thalach}\ \_|\ \_ \ {\tt chol}, \ {\tt age}, \ {\tt restecg}, \ {\tt trestbps}\ |\ {\tt sex}, \ {\tt exang}, \ {\tt heartdisease}, \ {\tt fbs})
(thalach _{-}|_ exang | sex, restecg, age, trestbps)
(thalach _
           _|_ exang | sex, fbs, age, trestbps)
(\verb|thalach _| \_| | \verb| age, exang | sex, fbs, restecg, trestbps|)
(thalach _|_ age | sex, exang, fbs, trestbps)
(\verb|thalach _|\_| \verb|sex|, \verb|fbs|, \verb|exang|, \verb|trestbps|| | \verb|chol|, \verb|age|, \verb|restecg|, \verb|heartdisease|)
(\verb|thalach _|\_| \verb|sex|, \verb|fbs|, \verb|restecg|, \verb|exang | \verb|trestbps|, \verb|chol|, \verb|age|, \verb|heartdisease|)
(\verb|thalach _|\_| \verb|sex|, \verb|restecg|, \verb|exang|, \verb|trestbps|| | \verb|chol|, \verb|age|, \verb|heartdisease|, \verb|fbs||)
           |_ sex, fbs, restecg, trestbps | exang, chol, age, heartdisease)
(thalach
(thalach _|_ sex, fbs, age, exang | trestbps, chol, restecg, heartdisease)
(\verb|thalach _|\_| \verb|sex|, age, exang, trestbps | chol, fbs, restecg, heartdisease)|\\
({\tt thalach}\ \_|\ \_{\tt sex},\ {\tt fbs},\ {\tt age},\ {\tt trestbps}\ |\ {\tt exang},\ {\tt chol},\ {\tt restecg},\ {\tt heartdisease})
(\verb|thalach _|\_| \verb|sex|, \verb|age|, \verb|restecg|, \verb|exang | \verb|trestbps|, \verb|chol|, \verb|fbs|, \verb|heartdisease|)
(thalach _
           _|_ sex, fbs, restecg, age | trestbps, exang, chol, heartdisease)
(thalach _ | _ sex, restecg, age, trestbps | exang, chol, fbs, heartdisease)
(thalach _|_ sex, exang | trestbps, chol, restecg, age)
(thalach _{-}|_ sex, exang | trestbps, chol, fbs, age)
(thalach _{-}|_{-} sex | trestbps, exang, chol, age)
(thalach \_|\_ sex, age, exang | chol, fbs, restecg, trestbps)
           _|_ sex, age | exang, chol, fbs, trestbps)
(thalach
({\tt thalach} \ \_| \ \_ \ {\tt sex}, \ {\tt chol}, \ {\tt fbs}, \ {\tt exang} \ | \ {\tt trestbps}, \ {\tt heartdisease}, \ {\tt restecg}, \ {\tt age})
(\verb|thalach _|\_| | \verb|sex|, \verb|chol|, \verb|exang|, \verb|trestbps|| | \verb|heartdisease|, \verb|fbs|, \verb|restecg|, \verb|age|)
(thalach \_|\_ sex, chol, fbs, trestbps | exang, heartdisease, restecg, age)
(thalach _| sex, chol, restecg, exang | trestbps, heartdisease, fbs, age)
           _|_ sex, chol, restecg, fbs | trestbps, exang, heartdisease, age)
(thalach
(thalach _| sex, chol, restecg, trestbps | exang, heartdisease, fbs, age)
(thalach _|_ sex, chol, age, exang | heartdisease, fbs, restecg, trestbps)
(thalach _|_ sex, chol, age, fbs | exang, heartdisease, restecg, trestbps)
(\verb|thalach _|\_| | \verb|sex|, \verb|chol|, \verb|age|, \verb|trestbps|| | exang, \verb|heartdisease|, \verb|restecg|, \verb|fbs||)
({\tt thalach}\ \_|\ \_{\tt sex},\ {\tt chol},\ {\tt restecg},\ {\tt age}\ |\ {\tt exang},\ {\tt heartdisease},\ {\tt fbs},\ {\tt trestbps})
(thalach _{-}|_ sex, exang | trestbps, fbs, restecg, age)
(thalach _|_ sex | trestbps, exang, restecg, age)
(thalach _|_ sex | trestbps, exang, fbs, age)
(thalach _{-}|_ sex, age | exang, fbs, restecg, trestbps)
({\tt thalach} \ \_| \ \_ \ {\tt trestbps}, \ {\tt fbs}, \ {\tt exang} \ | \ {\tt sex}, \ {\tt heartdisease}, \ {\tt age}, \ {\tt restecg}, \ {\tt chol})
           _|_ fbs, restecg, exang | sex, heartdisease, age, trestbps, chol)
(\verb|thalach _| \_| \verb| trestbps, restecg, exang | sex, heartdisease, age, chol, fbs)|\\
(thalach _{-}|_ fbs, restecg, trestbps | sex, heartdisease, age, chol, exang)
(\verb|thalach _| \_| \verb|fbs|, \verb|age|, \verb|exang | \verb|sex|, \verb|heartdisease|, \verb|restecg|, \verb|trestbps|, \verb|chol|)
(\verb|thalach _|\_| = \verb|exang|, age, trestbps | sex, heartdisease, restecg, chol, fbs)
(\verb|thalach _|\_| fbs, age, trestbps | sex, heartdisease, restecg, chol, exang)|\\
           _|_ age, restecg, exang | sex, heartdisease, trestbps, chol, fbs)
(thalach
(thalach _|_ fbs, restecg, age | sex, heartdisease, trestbps, chol, exang)
(\verb|thalach _| \_| | \verb| age, restecg, trestbps | sex, heartdisease, fbs, chol, exang)
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```

# 7.2.3.Inferencing with Bayesian Network

```
In [36]:
```

```
# Doing exact inference using Variable Elimination
from pgmpy.inference import VariableElimination
HeartDisease_infer = VariableElimination(model)

# Computing the probability of bronc given smoke.
q = HeartDisease_infer.query(variables=['heartdisease'], evidence={'age': 28})
print(q['heartdisease'])
```

heartdisease	phi(heartdisease)
heartdisease_0	0.6333
heartdisease_1	0.3667

### In [37]:

```
q = HeartDisease_infer.query(variables=['heartdisease'], evidence={'chol': 100})
print(q['heartdisease'])
```

heartdisease	phi(heartdisease)
heartdisease_0	1.0000
heartdisease_1	0.0000