

Quiz on Section 2 Results for SevdanurGenc

! Correct answers are hidden.

Score for this attempt: **12** out of 12

Submitted Jun 22 at 6:29pm

This attempt took 152 minutes.

Question 1

1 / 1 pts

How do you create a BQM if you have a matrix representation Q of a QUBO formulation?

- ☒ `bqm = BQM(Q, "BINARY")`
- ☐ `bqm_np = Q.to_bqm()`
- ☐ `bqm = BQM(Q)`
- ☐ `bqm_np = BQM(Q, "QUBO")`

Question 2

1 / 1 pts

Given the Ising model $3s_1 - s_2 + s_1s_2$ what is the spin assignment and energy that corresponds to the ground state?

- ☐ $s_1 = 0, s_2 = 1, \text{ energy} = -1$
- ☐ $s_1 = 1, s_2 = 0, \text{ energy} = 3$
- ☐ $s_1 = -1, s_2 = 1, \text{ energy} = 5$
- ☒ $s_1 = -1, s_2 = 1, \text{ energy} = -5$

Question 3

1 / 1 pts

For a complete graph with 3 vertices $\{0,1,2\}$, write down Ising model for the Max-Cut problem.

☒ $\frac{1}{2} (s_0s_1 + s_0s_2 + s_1s_2 - 3)$

☐ $\frac{1}{2} (s_0s_1 + s_0s_2 + s_1s_2 - 1)$

☐ $\frac{1}{2} (s_0s_1s_2 - 3)$

☐ $\frac{1}{2} (s_0 + s_1 + s_2 - 3)$

Question 4

1 / 1 pts

Given $S = \{3, 5, -3, 4, 7\}$, write down the Ising model for the number partitioning problem.

☒ $(3s_0 + 5s_1 - 3s_2 + 4s_3 + 7s_4)^2$

☐ $(3s_0 + 5s_1 - 3s_2 + 4s_3 + 7s_4)$

☐ $(3s_0s_1 - 3s_2s_3 + 7s_4)^2$

☐ $(3s_0 + 5s_1 + 3s_2 + 4s_3 + 7s_4)^2$

Question 5

1 / 1 pts

Given the QUBO formulation $-2x_1 - 4x_2 + 3x_1x_2$ write down the corresponding Ising model.

☐ $-\frac{3}{4} s_1 + \frac{5}{4} s_2 + \frac{3}{4} s_1s_2 - \frac{9}{4}$

☐ $\frac{1}{4} s_1 + \frac{5}{4} s_2 + \frac{3}{4} s_1 s_2 + \frac{9}{4}$

☒ $-\frac{1}{4} s_1 - \frac{5}{4} s_2 + \frac{3}{4} s_1 s_2 - \frac{9}{4}$

☐ $-\frac{3}{4} s_1 + \frac{5}{4} s_2 + \frac{1}{4} s_1 s_2 + \frac{9}{4}$

Question 6

1 / 1 pts

Given the Ising model $2s_1 + 4s_2 - 3s_1s_2$ write down the corresponding QUBO formulation.

☐ $2x_1 - 14x_2 - 12x_1x_2 - 12$

☐ $10x_1 - 14x_2 - 12x_1x_2 - 12$

☐ $10x_1 - 14x_2 + 2x_1x_2 - 12$

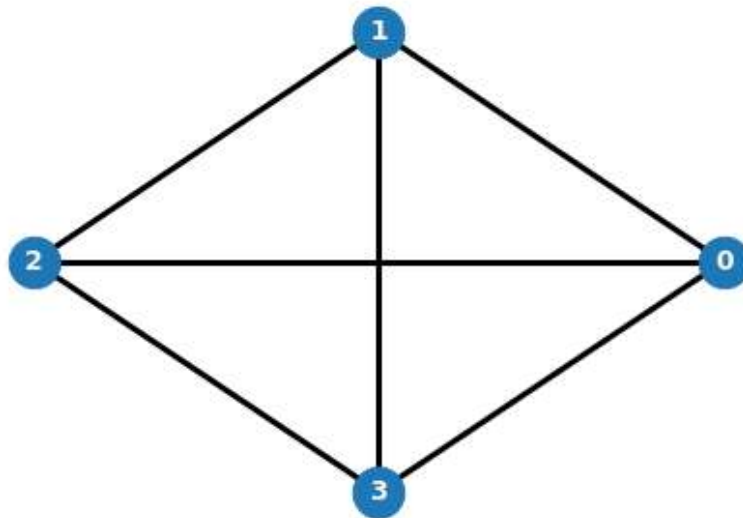
☒ $10x_1 + 14x_2 - 12x_1x_2 - 9$

Question 7

1 / 1 pts

Select the QUBO dictionary representing a max-cut problem for the following graph.

```
import networkx as nx
G = nx.turan_graph(4, 4)
```



$\{(\emptyset, \emptyset): -8, (1, 1): -3, (\emptyset, 1): 5, (2, 2): -3, (\emptyset, 2): 2, (3, 3): -3, (\emptyset, 3): 2, (1, 2): 2, (1, 3): 2, (2, 3): 2\}$



$\{(\emptyset, \emptyset): -3, (1, 1): -3, (\emptyset, 1): 2, (2, 2): -3, (\emptyset, 2): 2, (3, 3): -3, (\emptyset, 3): 2, (1, 2): 2, (1, 3): 2, (2, 3): 2\}$



$\{(\emptyset, \emptyset): -7, (1, 1): -5, (\emptyset, 1): 2, (2, 2): -3, (\emptyset, 2): 2, (3, 3): -3, (\emptyset, 3): 2, (1, 2): 2, (1, 3): 2, (2, 3): 2\}$



$\{(\emptyset, \emptyset): 1, (1, 1): -10, (\emptyset, 1): 2, (2, 2): -3, (\emptyset, 2): 2, (3, 3): -3, (\emptyset, 3): 2, (1, 2): 2, (1, 3): 2, (2, 3): 2\}$

Question 8

1 / 1 pts

Given the following parameters, how do you create a BQM instance in D-Wave for a model where variables take values 0 or 1. Select all the correct options.

`linear = {'x1': -5, 'x2': -3, 'x3': -8, 'x4': -6}`

`quadratic = {('x1', 'x2'): 4, ('x1', 'x3'): 8, ('x2', 'x3'): 2, ('x3', 'x4'): 10}`

☒ `bqm = BQM(linear, quadratic, vartype = "BINARY")`

☐ `bqm = BQM(linear, quadratic, "binary")`

☐ `bqm = BQM(linear, quadratic)`

☒ `bqm = BQM(linear, quadratic, "BINARY")`

Question 9

1 / 1 pts

What is the corresponding QUBO formulation for the given BQM instance?

```
BinaryQuadraticModel({'x1': 5.0, 'x2': -2.0, 'x3': -1.0}, {'('x2', 'x1)': 1.0, ('x3', 'x1)': 3.0, ('x3', 'x2)': -2.0}, 0.0, 'BINARY')
```

☐ $x_1 - 2x_2 - x_3 + x_1x_2 + 3x_1x_3 - 2x_2x_3$

☐ $5x_1 - 2x_2 - x_3 + x_1x_2 + x_1x_3 - x_2x_3$

☒ $5x_1 - 2x_2 - x_3 + x_1x_2 + 3x_1x_3 - 2x_2x_3$

☐ $x_1x_2 + 3x_1x_3 - 2x_2x_3$

Question 10

1 / 1 pts

Select the corresponding BQM instance for the following objective function

$$2s_1 + s_2 - 3s_3 - s_1s_3 - 8s_1s_2 - 4s_2s_3 + 10 \quad s_1, s_2, s_3 \in \{-1, +1\}$$

< >

☐

```
BinaryQuadraticModel({'s1': 2.0, 's3': -3.0, 's2': 1.0}, {'('s3', 's1)': -1.0, ('s2', 's1)': -8.0, ('s2', 's3)': -4.0}, 10.0, 'BINARY')
```



```
BinaryQuadraticModel({'s1': 2.0, 's3': -3.0, 's2': 1.0}, {'(s3, s1)':  
-1.0, ('s2', 's1)': -8.0, ('s2', 's3)': -4.0}, 10.0, 'SPIN')
```



```
BinaryQuadraticModel({'s1': 2.0, 's3': -3.0, 's2': 1.0}, {'(s3, s1)':  
-1.0, ('s2', 's1)': -8.0, ('s2', 's3)': -4.0}, 10.0)
```



```
BinaryQuadraticModel({'s1': 2.0, 's3': -3.0, 's2': 1.0}, {'(s3, s1)':  
-1.0, ('s2', 's1)': -8.0, ('s2', 's3)': -4.0}, 'SPIN')
```

Question 11

1 / 1 pts

Select all the code snippets that would create an empty BQM with no variables.



```
bqm = dimod.BQM({'x1': 1, 'x2': 0}, {}, vartype="BINARY")
```



```
bqm = dimod.BQM({0: 1, 1: 1}, {}, vartype="BINARY")
```



```
bqm = dimod.BQM(vartype="SPIN")
```



```
bqm = dimod.BQM(vartype="BINARY")
```

Question 12

1 / 1 pts

Reformulate the following HOBQ problem as a QUBO problem.

$$f(x_1, x_2, x_3) = x_1 + 2x_2 + 7x_1x_2x_3$$



$$f(x_1, x_2, x_3, y_{12}) = x_1 + 2x_2 + 7y_{12}x_3 + C \cdot (x_1x_2 - 2x_1y_{12} - 2x_2y_{12} + 3y_{12})$$



$$f(x_1, x_2, x_3, y_{12}) = x_1 + 2x_2 + 7y_{12}x_1 + C \cdot (x_1x_2 - 2x_1y_{12} - 2x_2y_{12} + 3y_{12})$$



$$f(x_1, x_2, x_3, y_{23}) = x_1 + 2x_2 + 7y_{23}x_1 + C \cdot (x_1x_2 - 2x_1y_{23} - 2x_2y_{23} + 3y_{23})$$



$$f(x_1, x_2, x_3, y_{12}) = x_1 + 2x_2 + 7y_{12}x_3 + C \cdot (x_1x_2 + 2x_1y_{12} + 2x_2y_{12} + 3y_{12})$$

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