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Assignment 3

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Question 1 Discrete Probability Theory

1. (a) All people = 20+5 = 25

$$P(4T) = \frac{^5C_4}{^{25}C_4} = \frac{1}{2530} = 3.9526 \times 10^{-4}$$

(b) $$P(2T2P) = \frac{^{20}C_2 \cdot {}^5C_2}{^{25}C_4} = \frac{38}{253} = 0.1502$$

2. N : Kamal buy a new car

C : Kamal live on campus

$P(N \cap C) = 0.37$

$P(C) = 0.73$

$$P(N|C) = \frac{P(N \cap C)}{P(C)}$$

$$= \frac{0.37}{0.73}$$

$$= \frac{37}{73}$$

$$= 0.5068$$

3. (a) E : Sum of numbers on dice is even

E = {(1,1), (1,3), (1,5), (2,2), (2,4), (2,6), (3,1), (3,3), (3,5), (4,2), (4,4), (4,6), (5,1), (5,3), (5,5), (6,2), (6,4), (6,6)}

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(b) N: Sum of numbers is 9

$N = \{(3,6), (4,5), (5,4), (6,3)\}$

$P(N) = \frac{4}{6 \times 6} = \frac{1}{9} = 0.1111$

(c) A: Sum of numbers is 7

$A = \{(1,6), (2,5), (3,4), (4,3), (5,2), (6,1)\}$

B: Sum of numbers is 8

$B = \{(2,6), (3,5), (4,4), (5,3), (6,2)\}$

$A \cup B = \{(1,6), (2,5), (2,6), (3,4), (3,5), (4,3), (4,4), (5,2), (5,3), (6,1), (6,2)\}$

$P(A \cup B) = \frac{6}{36} + \frac{5}{36}$

$= \frac{11}{36}$

$= 0.3056$

Question 2 Bayes' Theorem

1. (a) $P(A) = 0.55$

$P(D) = 0.10$

$P(N) = 0.35$

(b) $P(B|A) = 0.01$

$P(B|D) = 0.03$

$P(B|N) = 0.03$

$P(B) = P(B|A)P(A) + P(B|D)P(D) + P(B|N)P(N)$

$= 0.01(0.55) + 0.03(0.10) + 0.03(0.35)$

$= 0.019$

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2. (a) R : RT_PCR test Positive

I : Active Covid 19 Infection

$P(I) = 0.15$

$P(R|I) = 0.95$

$P(R|I') = 0.02$

$P(I') = 1 - 0.15$

$= 0.85$

$$P(I|R) = \frac{P(R|I)P(I)}{P(R|I)P(I) + P(R|I')P(I')}$$

$$= \frac{(0.95)(0.15)}{(0.95)(0.15) + (0.02)(0.85)}$$

$$= \frac{285}{319}$$

$$= 0.8934$$

(b) $$P(I'|R) = \frac{P(R|I')P(I')}{P(R|I')P(I') + P(R|I)P(I)}$$

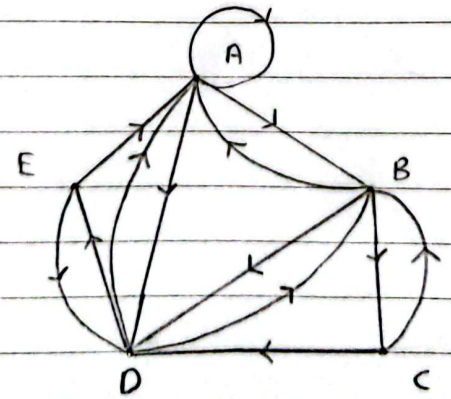
$$= \frac{(0.02)(0.85)}{(0.02)(0.85) + (0.95)(0.15)}$$

$$= \frac{34}{319}$$

$$= 0.1066$$

Question 3 Graph Definition and Notation

1. (a)



(b) deg (A) = 7

deg (B) = 6

deg (C) = 3

deg (D) = 7

deg (E) = 3

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2. (a) Vertice : A point or dot where two or more lines, curves, rays, edges, or line segments meet.

(b) Edge : A line that connect between the nodes (verticles) of the network in graph.

(c) Loop : An edge incident on a single vertex.

(d) Parallel edges : Two or more distinct edges with the same set of end points.

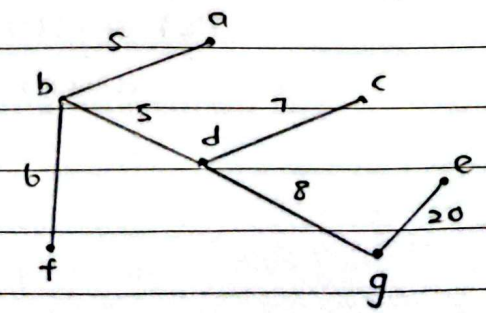
(e) Degree of vertex : The number of edges incident with verticles.

Question 4 Representation of Graphs

1. (a) disjoint vertex set 1 : $\{v_1, v_2, v_5\}$
disjoint vertex set 2 : $\{v_3, v_4\}$

(b) Simple graph, connected graph, undirected graph

2.



Cost = 5+6+5+7+8+20
= 51

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Question 5 Isomorphism of Graph

1.

Properties	G_1	G_2
Number of verticles	7	7
Number of edges	7	7
Number of degrees	All verticles have 2 degree	All verticles have 2 degree

Both G_1 and G_2 have 7 verticles and 7 edges.

Both are connected and simple graph.

Both have 7 verticles with 2 degree.

$f: G_1 \rightarrow G_2$ can be defined.

$f(a)=1$, $f(b)=6$, $f(c)=4$, $f(d)=2$, $f(e)=7$, $f(f)=5$, $f(g)=3$

Adjacency matrix:

A_{G_1} =

	a	b	c	d	e	f	g
a	0	1	0	0	0	0	1
b	1	0	1	0	0	0	0
c	0	1	0	1	0	0	0
d	0	0	1	0	1	0	0
e	0	0	0	1	0	1	0
f	0	0	0	0	1	0	1
g	1	0	0	0	0	1	0

A_{G_2} =

	1	6	4	2	7	5	3
1	0	1	0	0	0	0	1
6	1	0	1	0	0	0	0
4	0	1	0	1	0	0	0
2	0	0	1	0	1	0	0
7	0	0	0	1	0	1	0
5	0	0	0	0	1	0	1
3	0	0	0	1	0	1	0

$\therefore A_{G_1} = A_{G_2}$

Hence, both G_1 and G_2 are isomorphic.

2. (a)

Properties	G_1	G_2
Number of verticles	6	6
Number of edges	9	9
Number of degrees	All verticles have 3 degree	All verticles have 3 degree

Both G_1 and G_2 have 6 verticles and 9 edges.

Both are connected and simple graph.

Both have 6 verticles with 3 degree.

However, $f: G_1 \rightarrow G_2$ cannot be defined.

Hence, G_1 and G_2 are not isomorphic.

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(b)

Properties	G_1	G_2
Number of verticles	6	6
Number of edges	11	11
Number of degrees	2 verticles with 3 degree, 4 verticles with 4 degree	2 verticles with 3 degree, 4 verticles with 4 degree

Both G_1 and G_2 have 6 verticles and 11 edges.

Both are simple and connected graph.

Both have 2 verticles with 3 degree and 4 verticles with 4 degree.

However, function $f: G_1 \rightarrow$ cannot be defined.

Hence, G_1 and G_2 are not isomorphic.

3.