$(77.7 \text{ out of } 100) + (2.3 \text{ bonus}) = 80.03$

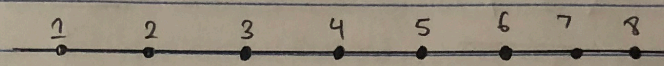
TA: Fatemeh Banaeizadeh

Comp 3203 Assignment 2

1.

5

1.1



$n = 8$

$k = 5$

Given that the node pairs occur left to right, and can only travel in a straight line without skipping nodes, k would have to be in between i and j for the unique shortest path to go through k: ∴

nodes before $k = k-1$

nodes after $k = n-k$

∴ the # of pairs would be $(k-1)(n-k)$

$k(n-k+1)-1$

1.2

$(k-1)(100-k)$

Figure?

1.3

The number of paths passing through k will be maximized when k is as close to the middle as possible:

$\therefore = \lceil (n+1)/2 \rceil$

$= \lceil 101/2 \rceil$

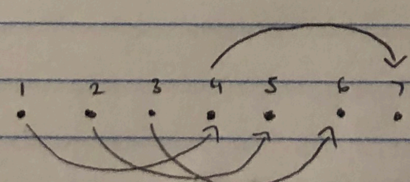
$= 51$

$k = \frac{n}{2}$

2.

7

2.1



$d = 3$

$n = 7$

∴ $n-d$ pairs will have a hop distance of d.

There is no explanation. please write how you got these formulas.

2.2

$$\frac{\sum_{i=1}^{n} i\left(\frac{i-1}{2}\right)}{\frac{n(n-1)}{2}}$$

2.3

$$\frac{n+1}{3}$$

3.

5

3.1

2^s as you have S bits to create your sequence #'s

3.2

30×2^s There is 60 mins in an hour. The amount of packets you can transmit in 2 mins with different sequence numbers times 30 mins as # of packets is in 2 minute window.

3.3

$30 \times ((L+S) \cdot 2^s)$

$30 \times L \times 2^S$

3.4

4.

10

4.1

loss of probability per fragment = p

probability of success per fragment = 1-p

5 fragments per window = $(1-p)^{\cancel{5}\,60}$

4.2

p^{ω} $p^5 \rightarrow$ p is the probability of loss per fragment. losses are independent events

4.3

$$\binom{5}{2} \cdot p^2 \cdot (1-p)^3$$

$$\binom{\omega}{2} p^2 (1-p)^{\omega-2}$$

4.4

F_5 arrive $= (1-p)$

F_4 arrive $= (1-p)$

F_3 arrive $= (1-p)$

F_2 lost $= p$

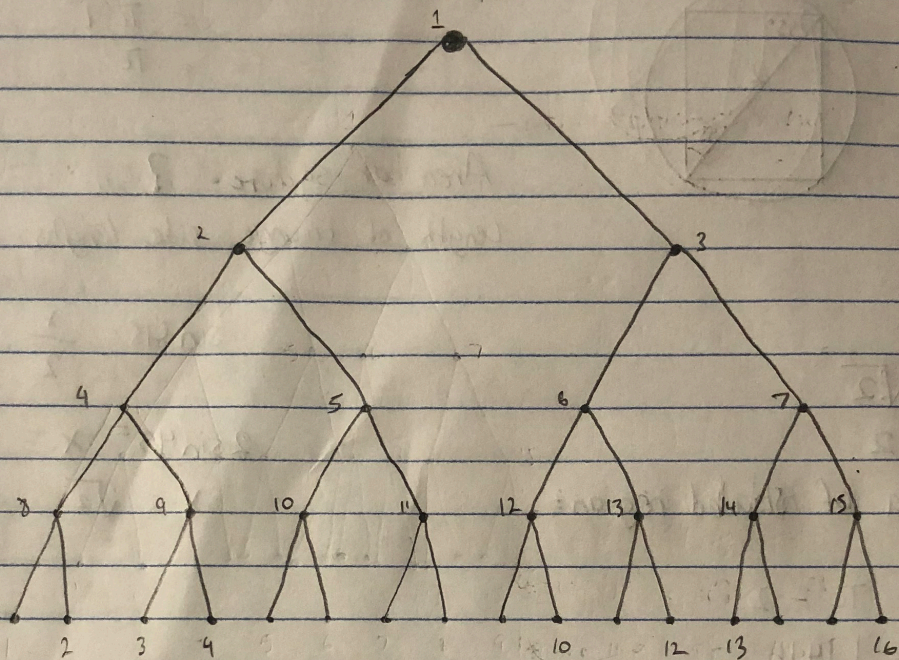
F_1 lost $= p$

$\therefore (1-p)^3 \cdot p^2$

$(1-p)^{\omega} p^2$

5.

10



Slot 1: 2, 3, 4, 10, 12, 13, 16 (collision)

Slot 2: 2, 3, 4 (collision)

Slot 3: 2, 3, 4 (collision)

Slot 4: 2 (success)

Slot 5: 3, 4 (collision)

Slot 6: 3 (success)

Slot 7: 4 (success)

Slot 8: 10, 12, 13, 16 (collision)

Slot 9: 10, 12 (collision)

Slot 10: 10 (success)

Slot 11: 12 (success)

Slot 12: 13, 16 collision

Slot 13: 13 (success)

Slot 14: 16 (success)

10

6. Wireless Hosts converted:

a := -1 +1 +1 +1 -1 +1 -1 +1

b := +1 -1 +1 -1 +1 -1 -1 +1

c := +1 +1 +1 -1 -1 +1 -1 +1

Dot Products:

$\{a, b\} = (-1) + (-1) + (1) + (-1) + (-1) + (-1) + (1) + (1)$
$= -2$

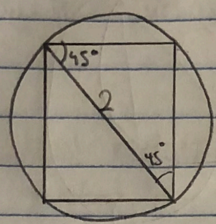
$\{a, c\} = (-1) + (1) + (1) + (-1) + (1) + (1) + 1 + 1$
$= 4$

$\{b, c\} = 1 + (-1) + 1 + 1 + (-1) + (-1) + 1 + 1$
$= 2$

After computing the dot product for each of the pairs, one can see that none of the pairs are orthogonal. This is because for the pair to be orthogonal their dot product would have to equal 0, which is not the case for any of the pairs.

5 7.

7.1



Area of circle $= \pi R^2$

$= \pi 1^2$

$= \pi$

Area of square = ?

Length of triangle side lengths:

$\sin 45 = \frac{x}{2}$

$2 \sin 45 = x$

$x = \sqrt{2}$

$= \sqrt{2}^2$

$= 2$

Area of shaded region:

$= \pi - 2$

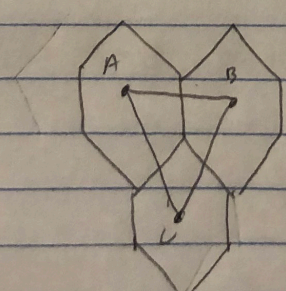
$= 1.1416$

Probability of striking inside the disk but outside the square:

$= \frac{1.1416}{\pi} = 0.3634$

7.2 A hexagon has a radius that is equal to its side length

$\therefore r = 1$



From: point A to point B $= 2r$

point A to point C $= 2r$

point B to point C $= 2r$

$\therefore$ perimeter $= \cancel{6r}$

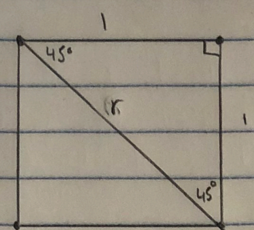
$= 6$

$3\sqrt{3}$

8

8.

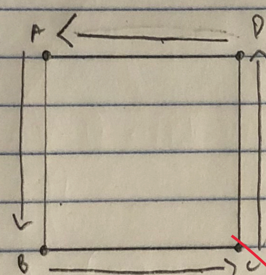
8.1



The required range r to form a complete network is:

$$a^2 + b^2 = c^2$$
$$1^2 + 1^2 = c^2$$
$$2 = c^2$$
$$c = \sqrt{2}$$

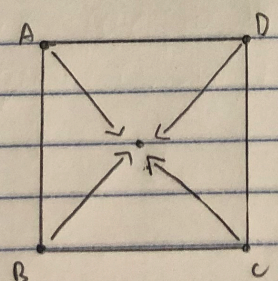
8.2



The antanae can be orientated directly facing another antanae (as shown) so that the network is complete

Orientation: A to B
B to C
C to D
D to A

8.3



$\sqrt{2}$

The min range of r is the distance to the centrepoint so half of $\sqrt{2}$ or $\frac{\sqrt{2}}{2}$. The antanae should be oriented towards the centerpoint or the antanae directly across from it.

8.4

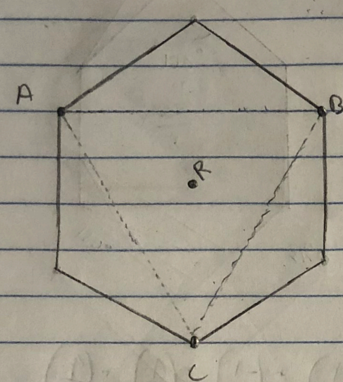
No there is no orientation of the antanae where the network would be complete with an angle of $\frac{\pi}{2}$.

10

9.

9.1

$$\frac{2\pi}{3} = 120^\circ$$

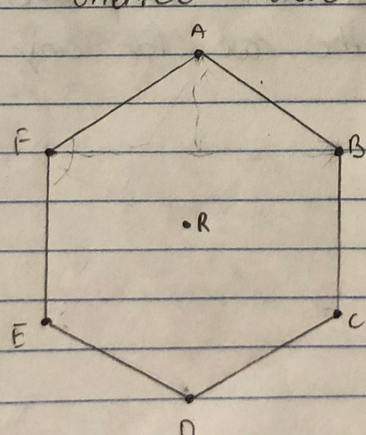


The minimum number of antenae required is 3. This is due to the fact that hexagons have interior angles of 120°. In addition having a range of 1 and a side length of 1 means that all 3 antanae could reach the center point as hexagons have a radius equal to their side length.

Orientation: Antanae C to AB
Antanae A to BC
Antanae B to AC

9.2

Given that the antanae now have half the beam-width, we will now need twice as many antenae (6) all oriented toward the antanae opposite to them



Orientation: A to D, B to E, C to F, D to A, E to B, F to C