Solution ECS 452 : In-Class Exercise # 1

Instructions

1. Separate into groups of no more than three persons.
2. The group cannot be the same as your former group.
3. Only one submission is needed for each group.
4. ***Write down all the steps*** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
5. **Do not panic.**

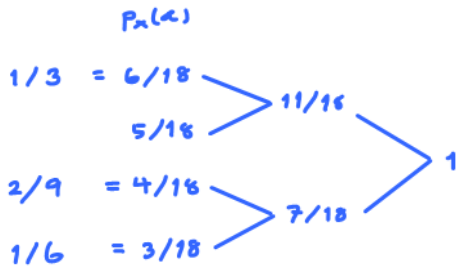
Date: 31 / 01 / 2017	
Name	ID (last 3 digits)
Prapun	555

1. Consider a random variable X having four possible values. Their probabilities are

   1/6, 2/9, 5/18, 1/3.

   Find the **expected codeword length** (per symbol) when **Huffman coding** is used (without extension) to encode an i.i.d sequence generated by this random variable.

Recipe: Combine the two least likely (combined) symbols



$\ell(x)$: 2, 2, 2, 2

Note that we can find $\ell(x)$ without writing down $c(x)$ first.

$\Downarrow$

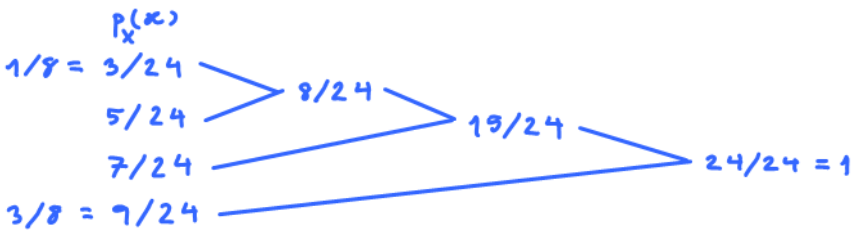
$\mathbb{E}[\ell(X)] = 2$ bits (per symbol)

2. Consider a random variable X having four possible values. Their probabilities are

   1/8, 5/24, 7/24, 3/8.

   Find the **expected codeword length** (per symbol) when **Huffman coding** is used (without extension) to encode an i.i.d sequence generated by this random variable.

Recipe: Combine the two least likely (combined) symbols



$\ell(x)$: 3, 3, 2, 1

Note that we can find $\ell(x)$ without writing down $c(x)$ first.

$$\mathbb{E}[\ell(X)] = 3\times\frac{3}{24} + 3\times\frac{5}{24} + 2\times\frac{7}{24} + 1\times\frac{9}{24} = \frac{9+15+14+9}{24} = \frac{47}{24} \approx 1.9583 \text{ [bits]}$$