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CS 206 HW1

1. The 1st password contains 16 characters

There are 52 for the amount of letter (upper or lower)
10 numbers
5 special characters

$52+10+5=67$

so it's $67^{16}=1.65\times10^{29}$

The 2st has 24 characters

26 letter for lowercase

it's $26^{24}=9.11\times10^{33}$

$26^{24}>67^{16}$

So the $\boxed{\text{second one is more secure}}$.

2. We know there are 10 numbers between 0~9

to better calculate this, we can set 1~1000000 to 0~999999 (to make it from 1 digit to 6 digits) because there's only one 7 digits number — 1000000 (we can add it in later)

among 0~9, there are 8 numbers aren't 1 or 5

and there's 1~6 digits.

∴ Among 0~999999, there are 8^6 numbers doesn't contain 1 or 5, so it's (8^6-1) numbers

In the question, ~~there~~ 0 is not in the list, so it's (8^6-1) numbers

And there's 1000000 which contains 1 (in the list)

so from 1~1000000, it's $1000000-(8^6-1)$ contains 1 or 5.

∴ It's $\boxed{737857}$

3. (a). 8 seats

$$\left(\frac{8}{S_1}\ \frac{7}{S_2}\ \frac{6}{S_3}\ \frac{5}{S_4}\ \frac{4}{S_5}\ \frac{3}{S_6}\ \frac{2}{S_7}\ \frac{1}{S_8}\right)=8!=\boxed{40320}$$

(b). According to the lecture.

$$|S|=8\cdot|A|$$
$$8!=8\cdot|A|$$
$$|A|=\frac{8!}{8}$$
$$=7!$$
$$=\boxed{5040}$$

(c). It's said Anna sits next to Brian, so they are always together

∴ we only need to consider the position of other 6 students

so it's $6!=720$

However, there can be two seating ways for Anna and Brian

Ana Brain _ _ _ _ _ _ or

Brian Anna _ _ _ _ _ _

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so its $720 \times 2 = \boxed{1440}$ arrangements

(d). similar to part (c).

The three students can seem as one part, they always sit together.

so it's $5! = 120$

And there are again two seatings way

... _ A B C _ ....

... _ C B A _ ...

∴ so it's $120 \times 2 = \boxed{240}$ arragements.

(e). This questions there are situations

① A sits with B

②. B sits with C

③. B sits with both A and C

we have calculated siting together for 2 people and 3people.

So we just add it

$1440 + 240 + 1440 = 3120$.

However, for ①、②, we included ③ in both of them,

to we need to delete the repeat of ③.

it's $3120 - 2 \times 240 = 2640$.

4. First we calculate $\binom{15}{5}$ to get how manys ways we can choose the 5 members from 15 people.

And then we use $\binom{15}{5}$ minus the choices that we chose no women to get the choices we chose at least one woman.

It's $\binom{15}{5} - \binom{6}{0} \cdot \binom{9}{5}$

$= 2877$

5. First we use mod 3 for all the numbers from 1~15.

Then I get

(1, 4, 7, 10, 13 mod 3 is 1)

(2, 5, 8, 11, 14 mod 3 is 2)

(3, 6, 9, 12, 15 mod 3 is 0)

For 2, 1, 0 ; there are all 5 numbers,

To make it divisible for 3, there are four possibilities for combination.

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① "0", "0", "0"

②. "1", "1", "1"

③. "2", "2", "2"

④. "0", "1", "2"

There's no order need, and the ~~they~~ ~~to~~ number we choose can't be repeated, so we use element subsets.

for ①: It's $\binom{5}{3}$

for ②. It's also $\binom{5}{3}$

for ③. It's also $\binom{5}{3}$

for ④. It's $\binom{5}{1} \cdot \binom{5}{1} \cdot \binom{5}{1}$

Answer: $\binom{5}{3} + \binom{5}{3} + \binom{5}{3} + \binom{5}{1} \cdot \binom{5}{1} \cdot \binom{5}{1}$

$= 10 + 10 + 10 + 5 \cdot 5 \cdot 5$

$= 30 + 125$

$= \boxed{155}$