Q1

Coincidental correctness arises when a defect is executed and the program has transitioned into an infectious state. It is when a test point follows an incorrect path, but still produces the same output by coincidence.

For example, let's take $\cos(2x)$. If we input $x = 2\pi$, we expect to get 1. However, if we mistakenly programmed the implementation of $\cos(2x)$ to be equivalent $\cos(4x)$, we'd still get the correct result given $x = 2\pi$, even though we'd see we had implemented $\cos(2x)$ incorrectly with a different value of x.

Q2

a)

Let

- a represent age < 25,
- b represent $25 \leq$ age ≤ 65, and
- c represent age > 65.

Since there are 2 possibilities for gender, two possibilities for city dwelling, and three possibilities for age group, the maximal number of rules is $2 \times 2 \times 3 = 12$.

Rule	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gender	M	M	M	M	M	M	F	F	F	F	F	F
City	Y	Y	Y	N	N	N	Y	Y	Y	N	N	N
Age group	a	b	c	a	b	c	a	b	c	a	b	c
A	★	★	★									
B	★			★								
C										★		
D	★	★		★	★		★	★	★	★	★	★

b)

Rules 7, 8, and 9 are equivalent and differ only in the age group. These can be combined into a single rule (rule #7). Furthermore, rules 11 and 12 can be combined into rule #7 as well.

Rule	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Gender	M	M	M	M	M	M	F	F
City	Y	Y	Y	N	N	N	-	N
Age group	a	b	c	a	b	c	-	a
A	★	★	★					
B	★			★				
C								★
D	★	★		★	★		★	★

Q3

Based on the equations, for the EPC tests, we ascertain

Variable	Slightly over max	Max	Min	Slightly under min
x	9	8	1	0
y	7	6	-1	-2
z	7	6	0	-1

These are all the EPC test cases:

TestID	**Desc.**	x	y	z	**Expected**
1	Valid case	4	4	4	In domain
2	EPC case	9	7	7	Out of domain
3	EPC case	9	7	6	Out of domain
4	EPC case	9	7	0	Out of domain
5	EPC case	9	7	-1	Out of domain
6	EPC case	9	6	7	Out of domain
7	EPC case	9	6	6	Out of domain
8	EPC case	9	6	0	Out of domain

9	EPC case	9	6	-1	Out of domain
10	EPC case	9	-1	7	Out of domain
11	EPC case	9	-1	6	Out of domain
12	EPC case	9	-1	0	Out of domain
13	EPC case	9	-1	-1	Out of domain
14	EPC case	9	-2	7	Out of domain
15	EPC case	9	-2	6	Out of domain
16	EPC case	9	-2	0	Out of domain
17	EPC case	9	-2	-1	Out of domain
18	EPC case	8	7	7	Out of domain
19	EPC case	8	7	6	Out of domain
20	EPC case	8	7	0	Out of domain
21	EPC case	8	7	-1	Out of domain
22	EPC case	8	6	7	Out of domain
23	EPC case	8	6	6	Out of domain
24	EPC case	8	6	0	Out of domain
25	EPC case	8	6	-1	Out of domain
26	EPC case	8	-1	7	Out of domain
27	EPC case	8	-1	6	Out of domain
28	EPC case	8	-1	0	Out of domain
29	EPC case	8	-1	-1	Out of domain
30	EPC case	8	-2	7	Out of domain
31	EPC case	8	-2	6	Out of domain
32	EPC case	8	-2	0	Out of domain
33	EPC case	8	-2	-1	Out of domain
34	EPC case	1	7	7	Out of domain
35	EPC case	1	7	6	Out of domain
36	EPC case	1	7	0	Out of domain
37	EPC case	1	7	-1	Out of domain
38	EPC case	1	6	7	Out of domain
39	EPC case	1	6	6	Out of domain
40	EPC case	1	6	0	Out of domain
41	EPC case	1	6	-1	Out of domain
42	EPC case	1	-1	7	Out of domain
43	EPC case	1	-1	6	Out of domain
44	EPC case	1	-1	0	Out of domain

45	EPC case	1	-1	-1	Out of domain
46	EPC case	1	-2	7	Out of domain
47	EPC case	1	-2	6	Out of domain
48	EPC case	1	-2	0	Out of domain
49	EPC case	1	-2	-1	Out of domain
50	EPC case	0	7	7	Out of domain
51	EPC case	0	7	6	Out of domain
52	EPC case	0	7	0	Out of domain
53	EPC case	0	7	-1	Out of domain
54	EPC case	0	6	7	Out of domain
55	EPC case	0	6	6	Out of domain
56	EPC case	0	6	0	Out of domain
57	EPC case	0	6	-1	Out of domain
58	EPC case	0	-1	7	Out of domain
59	EPC case	0	-1	6	Out of domain
60	EPC case	0	-1	0	Out of domain
61	EPC case	0	-1	-1	Out of domain
62	EPC case	0	-2	7	Out of domain
63	EPC case	0	-2	6	Out of domain
64	EPC case	0	-2	0	Out of domain
65	EPC case	0	-2	-1	Out of domain

For the weak $n \times 1$ testing, the $x + y \geq 0$ boundary can be ignored since it is outside of the domain. Hence, we will have 5 boundaries which means we will have $(3+1) \times 5 + 1 = 26$ test cases.

TestID	**Desc.**	x	y	z	**Expected**
1	Test case in domain	4	4	4	In domain
2	y <6	1	6	1	Outside domain
3	y <6	2	6	2	Outside domain
4	y <6	3	6	3	Outside domain
5	y <6	4	6	4	Outside domain
6	just outside y <6	5	5.5	5	In domain
7	x - y - 2 <= 0	9	7	1	In domain
8	x - y - 2 <= 0	7	5	2	In domain
9	x - y - 2 <= 0	5	3	3	In domain

10	x - y - 2 <= 0	3	1	4	In domain
11	just outside x - y - 2 <= 0	3	0.5	5	Outside domain
12	x >1	1	1	1	Outside domain
13	x >1	1	2	2	Outside domain
14	x >1	1	3	3	Outside domain
15	x >1	1	4	4	Outside domain
16	just outside x >1	0.5	5	5	In domain
17	z >0	1	1	0	Outside domain
18	z >0	2	2	0	Outside domain
19	z >0	3	3	0	Outside domain
20	z >0	4	4	0	Outside domain
21	just outside z >0	5	5	-0.5	In domain
22	z <6	1	1	6	Outside domain
23	z <6	2	2	6	Outside domain
24	z <6	3	3	6	Outside domain
25	z <6	4	4	6	Outside domain
26	just outside z <6	5	5	6.5	In domain

For the subdomain with four variables, you would need $4^4 + 1 = 257$ test cases.

Q4

The quadratic equation is hard to test for both EPC and weak $n \times 1$ strategies. This is because the boundary is not linear.

For EPC testing, because the input domain is unbounded for all inputs (a, b, c, and x), it is very difficult to test. If we were to bound the inputs, it would be more feasible.

For weak $n \times 1$ testing, this is again not very easy because the boundary is not linear. In order to test it with any reasonable accuracy, we would need many subdivisions.

Q5

We have

$$\begin{aligned}P(f_1) &= (0.5)(0.3)(0.0) + (0.5)(0.7)(0.1) + (0.1)(0.6)(0.5) + (0.1)(0.4)(0.1) \\ &+ (0.4)(0.7)(0.1) + (0.4)(0.3)(0.0) \\ &= 0.097,\end{aligned}$$

$$\begin{aligned}P(f_2) &= (0.5)(0.3)(0.3) + (0.5)(0.7)(0.1) + (0.1)(0.6)(0.1) + (0.1)(0.4)(0.9) \\ &+ (0.4)(0.7)(0.3) + (0.4)(0.3)(0.8) \\ &= 0.302,\end{aligned}$$

$$\begin{aligned}P(f_3) &= (0.5)(0.3)(0.5) + (0.5)(0.7)(0.3) + (0.1)(0.6)(0.0) + (0.1)(0.4)(0.0) \\ &+ (0.4)(0.7)(0.2) + (0.4)(0.3)(0.0) \\ &= 0.236,\end{aligned}$$

and

$$\begin{aligned}P(f_4) &= (0.5)(0.3)(0.2) + (0.5)(0.7)(0.5) + (0.1)(0.6)(0.4) + (0.1)(0.4)(0.0) \\ &+ (0.4)(0.7)(0.4) + (0.4)(0.3)(0.2) \\ &= 0.365.\end{aligned}$$

Therefore, the priority we should follow is $f_4 > f_2 > f_3 > f_1$.