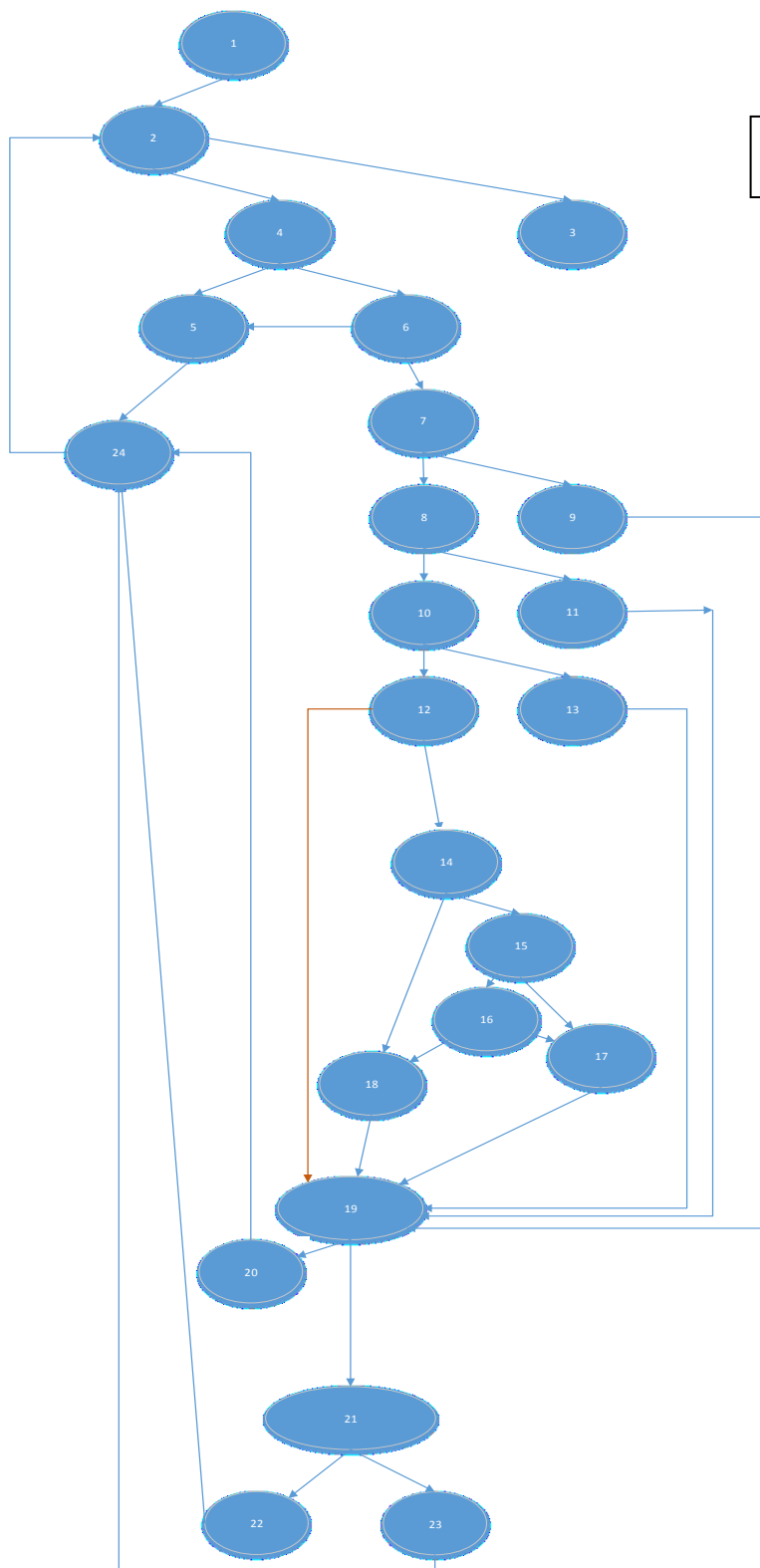


Assignment 2 Part 1 Solutions

1a) flow graph



Orange path: Infeasible edge

b) source code modification:

```

public void makeOrder(IngredientFactory factory) {
    output.print("Order started with ");
    Ingredient ingredient = factory.createCoffee();
    addIngredient(ingredient);
    showMenu();
    int option = getOption();

    while(option != 0) {
        if (option > 0 && option <= menu.length) {
            switch (option) {
                case 1: ingredient = factory.createChocolate(); break;
                case 2: ingredient = factory.createEspresso(); break;
                case 3: ingredient = factory.createLemon(); break;
                case 4: output.print("Do you want the milk steamed? (y/n): ");
                        String choice = scanner.next();
                        if (choice != null && (choice.equals("y") || choice.equals("Y"))) {
                            ingredient = factory.createSteamedMilk();
                        } else {
                            ingredient = factory.createMilk();
                        }
                        break;
            }

            if (!(isValidCombination(ingredient))) {
                output.println("Sorry, "
                    + ingredient.toString()
                    + " is not compatible with an earlier choice.");
            } else {
                ingredient.setShots(getNumberOfShots());
                if ((volume + ingredient.getVolume()) > MAX_VOLUME) {
                    output.println("Cup too full to add the ingredient.");
                } else {
                    addIngredient(ingredient);
                }
            }
            output.print("Not a valid choice.");
            option = getOption();
        }
        output.println("\nDone!! Please pay " + getTotalPrice() + " HKD.");
    }
}

```

c) cyclomatic complexity

$$35 - 24 + 2 = 13$$

d) basis set of independent paths

| Path | Covered nodes |
|------|---|
| 1 | 1-2-3 |
| 2 | 1-2-4-5-24-2-3 |
| 3 | 1-2-4-6-5-24-2-3 |
| 4 | 1-2-4-6-7-9-19-21-23-24-2-3 |
| 5 | 1-2-4-6-7-8-11-19-21-23-24-2-3 |
| 6 | 1-2-4-6-7-8-10-13-19-21-23-24-2-3 |
| 7 | 1-2-4-6-7-8-10-12-19-21-23-24-2-3 |
| 8 | 1-2-4-6-7-8-10-12-14-15-16-17-19-21-23-24-2-3 |
| 9 | 1-2-4-6-7-8-10-12-14-15-17-19-21-23-24-2-3 |

| | |
|----|--|
| 10 | 1-2-4-6-7-8-10-12-14-15-16-18-19-21-23-24-2-3 |
| 11 | 1-2-4-6-7-8-10-12-14-18-19-21-23-24-2-3 |
| 12 | 1-2-4-6-7-9-19-21-23-24-2-4-6-7-8-10-13-19-20-24-2-3 |
| 13 | 1-2-4-6-7-9-19-21-22-24-2-3 |

e) test cases

| Test case | Inputs and Conditions | Expected Results and Output |
|-----------|--|---|
| 1 | mockIngredient1: finalvolume(150), finalprice(100), name("A") Input: 0 | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to other creational methods: 0 • ingredients contains mockIngredient1 <p>Output contains:</p> <p>Order started with 150ml of A added. You can add 150 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 100.00 HKD.</p> |
| 2 | mockIngredient1: finalvolume(200), finalprice(20), name("A") Input: -1 0 | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to other creational methods: 0 • ingredients contains mockIngredient1 <p>Output contains:</p> <p>Order started with 200ml of A added. You can add 100 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> |

| | | |
|---|---|---|
| | | <p>Not a valid choice. Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 20.00 HKD.</p> |
| 3 | <p>mockIngredient1: finalvolume(50), finalprice(30), name("A")</p> <p>Input: 5 0</p> | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to other creational methods: 0 • ingredients contains mockIngredient1 <p>Output contains:</p> <p>Order started with 50ml of A added. You can add 250 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order: Not a valid choice. Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 30.00 HKD.</p> |
| 4 | <p>mockIngredient1: finalvolume(60), finalprice(10), name("A")</p> <p>mockIngredient2: finalvolume(60), finalprice(35), name("B")</p> <p>Input: 1 1 0</p> | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to createChocolate(): 1 (returns mockIngredient2) • Calls to other creational methods: 0 • Shots of mockIngredient2: 1 • ingredients contains mockIngredient1 and mockIngredient2 <p>Output contains:</p> <p>Order started with 60ml of A added. You can add 240 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk |

| | | |
|---|---|--|
| | | <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order: How many shots?: 60ml of B added. You can add 180 ml more ingredients.</p> <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 45.00 HKD.</p> |
| 5 | <p>mockIngredient1: finalvolume(70), finalprice(38), name("A")</p> <p>mockIngredient2: finalvolume(80), finalprice(22), name("B")</p> <p>Input: 2 2 0</p> | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to createEspresso(): 1 (returns mockIngredient2) • Calls to other creational methods: 0 • Shots of mockIngredient2: 2 • ingredients contains mockIngredient1 and mockIngredient2 <p>Output contains:</p> <p>Order started with 70ml of A added. You can add 230 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order: How many shots?: 80ml of B added. You can add 150 ml more ingredients.</p> <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 60.00 HKD.</p> |
| 6 | <p>mockIngredient1: finalvolume(140), finalprice(17), name("A")</p> <p>mockIngredient2: finalvolume(40), finalprice(10.7), name("B")</p> | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to createLemon(): 1 (returns mockIngredient2) • Calls to other creational methods: 0 • Shots of mockIngredient2: 1 • ingredients contains mockIngredient1 and mockIngredient2 |

| | | |
|---|--|---|
| | Input: 3 1 0 | <p>Output contains:</p> <p>Order started with 140ml of A added. You can add 160 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>How many shots?:</p> <p>40ml of B added. You can add 120 ml more ingredients.</p> <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 27.70 HKD.</p> |
| 7 | Not feasible | |
| 8 | <p>mockIngredient1: finalvolume(210), finalprice(25.5), name("A")</p> <p>mockIngredient2: finalvolume(10), finalprice(20), name("B")</p> <p>Input: 4 Y 1 0</p> | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to createSteamedMilk(): 1 (returns mockIngredient2) • Calls to other creational methods: 0 • Shots of mockIngredient2: 1 • ingredients contains mockIngredient1 and mockIngredient2 <p>Output contains:</p> <p>Order started with 210ml of A added. You can add 90 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Do you want the milk steamed? (y/n):</p> <p>How many shots?:</p> <p>10ml of B added. You can add 80 ml more ingredients.</p> |

| | | |
|----|--|--|
| | | <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 45.50 HKD.</p> |
| 9 | <p>mockIngredient1: finalvolume(215), finalprice(200), name("A")</p> <p>mockIngredient2: finalvolume(80), finalprice(100), name("B")</p> <p>Input: 4 y 1 0</p> | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to createSteamedMilk(): 1 (returns mockIngredient2) • Calls to other creational methods: 0 • Shots of mockIngredient2: 1 • ingredients contains mockIngredient1 and mockIngredient2 <p>Output contains:</p> <p>Order started with 215ml of A added. You can add 85 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Do you want the milk steamed? (y/n):</p> <p>How many shots?:</p> <p>80ml of B added. You can add 5 ml more ingredients.</p> <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 300.00 HKD.</p> |
| 10 | <p>mockIngredient1: finalvolume(250), finalprice(40), name("A")</p> <p>mockIngredient2: finalvolume(25), finalprice(19), name("B")</p> <p>Input: 4 n 1 0</p> | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to createMilk(): 1 (returns mockIngredient2) • Calls to other creational methods: 0 • Shots of mockIngredient2: 1 • ingredients contains mockIngredient1 and mockIngredient2 <p>Output contains:</p> <p>Order started with 250ml of A added. You can add</p> |

| | | |
|----|---|---|
| | | <p>50 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Do you want the milk steamed? (y/n):</p> <p>How many shots?:</p> <p>25ml of B added. You can add 25 ml more ingredients.</p> <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 59.00 HKD.</p> |
| 11 | See Part 2 | |
| 12 | <p>mockIngredient1: finalvolume(100), finalprice(20), name("A"),</p> <p>mockIngredient2: finalvolume(75), finalprice(30), name("B"), isCompatibleWith()(false)</p> <p>Input: 10</p> | <p>Expected Results:</p> <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to createChocolate(): 1 (returns mockIngredient2) • Calls to other creational methods: 0 • Shots of mockIngredient2: 1 • ingredients contains mockIngredient1 <p>Output contains:</p> <p>Order started with 100ml of A added. You can add 200 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Sorry, B is not compatible with an earlier choice.</p> <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 20.00 HKD.</p> |
| 13 | mockIngredient1: finalvolume(280), | Expected Results: |

| | | |
|--|---|--|
| | <pre>finalprice(55.5), name("A") mockIngredient2: finalvolume(21), finalprice(10), name("B") Input: 1 1 0</pre> | <ul style="list-style-type: none"> • Calls to createCoffee(): 1 (returns mockIngredient1) • Calls to createChocolate(): 1 (returns mockIngredient2) • Calls to other creational methods: 0 • Shots of mockIngredient2: 1 • ingredients contains mockIngredient1 <p>Output contains:</p> <p>Order started with 280ml of A added. You can add 20 ml more ingredients.</p> <p>What would you like to add to your coffee?</p> <ol style="list-style-type: none"> 1. Hot chocolate 2. Espresso 3. Lemon juice 4. Milk <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>How many shots?:</p> <p>Cup too full to add the ingredient.</p> <p>Enter your choice (1 - 4) to add an ingredient, or 0 to finish the order:</p> <p>Done!! Please pay 55.50 HKD.</p> |
|--|---|--|

****Note:** the expected results should be specified in terms of the post-conditions for the method