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Contents

List of Figures ix

List of Tables xiii

List of Algorithms xvii

1 Introduction 1
1.1 Motivation and Background 3
1.1.1 Motivation & Goals 3
1.1.2 Design 4
1.1.3 Implementation 5
1.1.4 Evaluation 5
1.1.5 Contribution 6
1.1.6 Our Implementation of Goals 7
1.2 Terminology and Notation 7
1.3 Assumptions and Limitations 12
1.4 Assertion Implementation 13
1.4.1 Writing Implementation 13
1.4.2 Manual Implementation 14
1.5 Terminology 15
1.5.1 On Small-Step's Terminology 16
1.5.2 Terminal Semantics and Small Terminal Forms 17
1.5.3 Multiple Goals of Termination 17
1.5.4 Non-Terminal 17

2 Preliminaries 19
2.1 Type and Subtyping Notation 21
2.1.1 Subtyping 21
2.1.2 Typing 22
2.1.3 Total Typing Relation 23
2.1.4 Function 23
2.1.5 Tuple 23
2.1.6 Subtyping Notation and Typing Judgements 23
2.1.7 Subtyping 24

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Table of Contents

1.1 Introduction 12
1.2 Mathematical Notation 14
1.3 Equation Tableau and Solution 16
1.4 Equation Manipulation 18
1.5 Introduction Inductions 19
1.6 Simultaneous Equations 19
1.7 Only Those Equations Is Consistent 20
1.8 Reducible Introduction, Point 1 23
1.9 Reducible Introduction, Point 2 25
1.10 Zeros Notation 25
1.11 Adding Equations 31
1.12 Multiple Total 32
1.13 Zeros Total 33
1.14 Mathematical Total 34
1.15 Equal-Magnitude Adding Equations 35
1.16 Reflune Introduction, Point 1 36
1.17 Reflune Introduction, Point 2 38
1.18 Examples Equivalent and Equivalence 39
1.19 Use Common Equation 39
1.20 Use Equation Classified 41
1.21 Not Common Equation 41
1.22 Not Tableau 1 43
1.23 Not Tableau 2 44
1.24 Not Tableau 3 46
1.25 Multiple Equations of Proportionality 48
1.26 Multiple Proportionality Examples 48
1.27 Formal Inequations Using Equations 48

2.1 Examples Summed, Point 1 53
2.2 Examples Summed, Point 2 56
2.3 Summed Sum's Examples 58
2.4 Mathematical Summed Inequalities 58

3.1 Real Numbers Inequalities 63

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Table of Contents

2.1 Maximum Flow Minimum Cut 33
2.2 Matching and Covering 75
2.3 Matrix Tree Theorem 78
2.4 Matroid Intersection and Matroid Union 81
2.5 Matroid Parity Problem 86

3.1 Minimum Cost Flow Problem 98
3.2 Network Simplex Method for Minimum Cost Flow 98
3.3 Transshipment Problem 99
3.4 Assignment Problem and Transportation Problem 101

4.1 Max-Flow Min-Cost Problem 99

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in the language to elements of the model and interprets the language as being about the model. The inference rules are used for reasoning or computation. Let's take a simple arithmetic language:

$$
\begin{aligned}
Exp &= Num \\
&\mid Exp + Exp \\
&\mid Exp \times Exp \\
&\mid (Exp) \\
Num &= Dig \mid Dig\ Num \\
Dig &= 0 \ldots 9
\end{aligned}
$$

An example expression is $2 \times (3 + 1)$. For a model, we have the usual natural numbers. For inference rules, we have the usual identity, associative, commutative, and distributive laws. The meaning function maps expressions to natural numbers. For example, it maps $2 \times (3 + 1)$ to 8. The inference rules must be sound; that is, they must preserve meanings. For example, if we apply the distributive law to $2 \times (3 + 1)$ to get $2 \times 3 + 2 \times 1$, the meaning of this totally different expression must also be 8. Note that we typically only a single model, while our definition allows a class of models; see [Hod93] for a more thorough treatment of logic.

Interestingly, we have two ways of evaluating expressions: inside the language, using the inference rules, and outside the language, using the meaning function. If we use the meaning function, we need a way to map results in the language in which the meaning function is defined (the meta-language). Sometimes this seems unnatural; for example, if we implement an evaluator for the above language in C, we use C's arithmetic. Sometimes it is not; in performing arithmetic by hand, we use the inference rules to justify the syntactic manipulations of the usual addition and multiplication algorithms. In this thesis, we build interpreters using meaning functions and focus on models rather than inference rules.

Most meaning functions are compositional: the meaning of an expression depends only on the meaning of its subexpressions, rather than their exact syntax. For example, in the arithmetic language, the meaning of $a + b$ is the sum of the meanings of a and b.

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1.2 Equipment and Methods

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第96章：第一次公开亮相，惊艳全场！

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第四章 数据库设计与实现

4.1 概念结构设计

4.1.1 实体-联系图（E-R图）

4.1.2 实体属性定义

4.2 逻辑结构设计

4.2.1 E-R图向关系模型的转换

4.2.2 关系模型的优化

4.3 物理结构设计

4.3.1 存储结构设计

4.3.2 索引设计

4.4 数据库实现

4.4.1 建表语句

4.4.2 视图设计

4.4.3 触发器设计

4.4.4 存储过程设计

4.5 数据库安全性设计

4.5.1 用户管理

4.5.2 权限管理

4.6 数据库维护

4.6.1 数据备份与恢复

4.6.2 性能监控与优化

4.7 本章小结

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Figura 1.[illegible]: [illegible] estimativa [illegible]

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一、Microservices 架构设计原则与拆分策略

1.1 单一职责原则（Single Responsibility Principle）

```
"order-service": {
  "port": 8081,
  "database": "order_db",
  "redis_prefix": "order:",
  "kafka_topic": "order.events",
  "dependencies": ["inventory-service", "payment-service"],
  "max_memory": "512MB",
  "health_check": "/actuator/health"
}
```

1.2 Docker Compose 配置

```
version: "3.8"
services:
  mysql:
    image: mysql:8.0
    container_name: mysql-master
    ports:
      - "3306:3306"
    environment:
      MYSQL_ROOT_PASSWORD: root_pass_2024
      MYSQL_DATABASE: order_db
      MYSQL_USER: app_user
      MYSQL_PASSWORD: app_pass_2024
    volumes:
      - mysql_data:/var/lib/mysql
      - ./mysql/conf.d:/etc/mysql/conf.d:ro
      - ./mysql/init.sql:/docker-entrypoint-initdb.d/init.sql:ro
    networks:
      - backend_network
    healthcheck:
      test: "mysqladmin ping -h localhost -u root -p$$MYSQL_ROOT_PASSWORD"
      interval: 10s
      timeout: 5s
      retry: 3
    restart: unless-stopped
    deploy:
      resource_limits:
        cpu: "2.0"
        memory: 4G
      reservations:
        cpu: "0.5"
        memory: 1G
  redis:
    image: redis:7.2-alpine
    container_name: redis-cluster-node1
    ports:
      - "6379:6379"
    command: redis-server /usr/local/etc/redis/redis.conf --requirepass redis_pass_2024 --appendonly yes --maxmemory 2gb --maxmemory-policy allkeys-lru
    volumes:
      - redis_data:/data
      - ./redis/redis.conf:/usr/local/etc/redis/redis.conf:ro
    networks:
      - backend_network
    healthcheck:
      test: "redis-cli -a redis_pass_2024 ping"
      interval: 5s
      timeout: 3s
      retry: 5
    restart: unless-stopped
    deploy:
      resource_limits:
        cpu: "1.0"
        memory: 2G
  kafka:
    image: confluent/kafka:7.6.0
    container_name: kafka-broker-1
    ports:
      - "9092:9092"
      - "9093:9093"
    environment:
      KAFKA_NODE_ID: 1
      KAFKA_PROCESS_ROLES: broker,controller
      KAFKA_LISTENERS: PLAINTEXT://:9092,CONTROLLER://:9093
      KAFKA_ADVERTISED_LISTENERS: PLAINTEXT://kafka:9092
      KAFKA_CONTROLLER_QUORUM_VOTERS: 1@kafka:9093
      KAFKA_LOG.DIRS: /tmp/kraft-combined-logs
      KAFKA_NUM_PARTITIONS: 12
      KAFKA_DEFAULT_REPLICATION_FACTOR: 1
      KAFKA_LOG.RETENTION.HOURS: 168
      KAFKA_LOG.SEGMENT.BYTES: 1073741824
      KAFKA_AUTO_CREATE_TOPICS_ENABLE: false
      KAFKA_COMPRESSION.TYPE: lz4
      KAFKA_MESSAGE.MAX.BYTES: 10485760
      KAFKA_REPLICA.FETCH.MAX.BYTES: 10485760
      KAFKA_JVM.OPTS: -Xmx2G -Xms2G -XX:+UseG1GC -XX:MaxGCPauseMillis=20
    volumes:
      - kafka_data:/tmp/kraft-combined-logs
    networks:
      - backend_network
    healthcheck:
      test: "kafka-topics.sh --bootstrap-server localhost:9092 --list"
      interval: 30s
      timeout: 10s
      retry: 3
    restart: unless-stopped
    deploy:
      resource_limits:
        cpu: "2.0"
        memory: 4G
  elasticsearch:
    image: elasticsearch:8.12.0
    container_name: elasticsearch-node1
    ports:
      - "9200:9200"
      - "9300:9300"
    environment:
      ES_JAVA_OPTS: -Xmx2G -Xms2G
      bootstrap.memory_lock: true
      xpack.security.enabled: false
      discovery.type: single-node
      cluster.name: order-cluster
      node.name: node-1
      xpack.security.enrollment.enabled: false
    volumes:
      - es_data:/usr/share/elasticsearch/data
      - ./elasticsearch/plugins:/usr/share/elasticsearch/plugins:ro
    networks:
      - backend_network
    healthcheck:
      test: "curl -s http://localhost:9200/_cluster/health?wait_for_status=yellow&timeout=50s"
      interval: 30s
      timeout: 60s
      retry: 5
    restart: unless-stopped
    deploy:
      resource_limits:
        cpu: "2.0"
        memory: 4G
  nginx:
    image: nginx:1.25.3-alpine
    container_name: nginx-gateway
    ports:
      - "80:80"
      - "443:443"
    volumes:
      - ./nginx/nginx.conf:/etc/nginx/nginx.conf:ro
      - ./nginx/conf.d:/etc/nginx/conf.d:ro
      - ./nginx/ssl:/etc/nginx/ssl:ro
      - ./nginx/static:/usr/share/nginx/static:ro
      - nginx_cache:/var/cache/nginx
    networks:
      - frontend_network
      - backend_network
    healthcheck:
      test: "curl -f http://localhost/health"
      interval: 10s
      timeout: 5s
      retry: 3
    restart: unless-stopped
    deploy:
      resource_limits:
        cpu: "1.0"
        memory: 512M
  prometheus:
    image: prometheus:v2.48.0
    container_name: prometheus-server
    ports:
      - "9090:9090"
    volumes:
      - ./prometheus/prometheus.yml:/etc/prometheus/prometheus.yml:ro
      - ./prometheus/rules:/etc/prometheus/rules:ro
      - prometheus_data:/data
    networks:
      - monitoring_network
      - backend_network
    healthcheck:
      test: "curl -f http://localhost:9090/-/healthy"
      interval: 30s
      timeout: 10s
      retry: 3
    restart: unless-stopped
    deploy:
      resource_limits:
        cpu: "1.0"
        memory: 2G
  grafana:
    image: grafana:10.2.3
    container_name: grafana-dashboard
    ports:
      - "3000:3000"
    volumes:
      - grafana_data:/var/lib/grafana
      - ./grafana/provisioning:/etc/grafana/provisioning:ro
      - ./grafana/dashboards:/var/lib/grafana/dashboards:ro
    networks:
      - monitoring_network
    healthcheck:
      test: "curl -f http://localhost:3000/api/health"
      interval: 30s
      timeout: 10s
      retry: 3
    restart: unless-stopped
    deploy:
      resource_limits:
        cpu: "0.5"
        memory: 512M
```

1.3 Kubernetes 部署配置

```
apiVersion: apiVersion: apiVersion: apiVersion: apiVersion: apiVersion: apiVersion:
  name: name: name: name: name: name: name:
  namespace: namespace: namespace: namespace: namespace: namespace: namespace:
  labels:
    app: app: app: app: app: app: app:
    version: version: version: version: version: version: version:
    component: component: component: component: component: component: component:
    tier: tier: tier: tier: tier: tier: tier:
  annotations:
    description: "description: description: description: description: description: description: description:"
    owner: "owner: owner: owner: owner: owner: owner: owner:"
    prometheus.io/scrape: "prometheus.io/scrape: prometheus.io/scrape: prometheus.io/scrape: prometheus.io/scrape: prometheus.io/scrape: prometheus.io/scrape:"
    prometheus.io/port: "prometheus.io/port: prometheus.io/port: prometheus.io/port: prometheus.io/port: prometheus.io/port: prometheus.io/port:"
    prometheus.io/path: "prometheus.io/path: prometheus.io/path: prometheus.io/path: prometheus.io/path: prometheus.io/path: prometheus.io/path:"
    kubernetes.io/change-cause: "kubernetes.io/change-cause: kubernetes.io/change-cause: kubernetes.io/change-cause: kubernetes.io/change-cause: kubernetes.io/change-cause: kubernetes.io/change-cause:"
spec: spec: spec: spec: spec: spec: spec:
  replicas: replicas: replicas: replicas: replicas: replicas: replicas:
  selector:
    matchLabels:
      app: app: app: app: app: app: app:
      version: version: version: version: version: version: version:
  strategy:
    type: type: type: type: type: type: type:
    rollingUpdate:
      maxSurge: maxSurge: maxSurge: maxSurge: maxSurge: maxSurge: maxSurge:
      maxUnavailable: maxUnavailable: maxUnavailable: maxUnavailable: maxUnavailable: maxUnavailable: maxUnavailable:
  template:
    metadata:
      labels:
        app: app: app: app: app: app: app:
        version: version: version: version: version: version: version:
        component: component: component: component: component: component: component:
        tier: tier: tier: tier: tier: tier: tier:
      annotations:
        prometheus.io/scrape: "prometheus.io/scrape: prometheus.io/scrape: prometheus.io/scrape: prometheus.io/scrape: prometheus.io/scrape: prometheus.io/scrape:"
        prometheus.io/port: "prometheus.io/port: prometheus.io/port: prometheus.io/port: prometheus.io/port: prometheus.io/port: prometheus.io/port:"
        prometheus.io/path: "prometheus.io/path: prometheus.io/path: prometheus.io/path: prometheus.io/path: prometheus.io/path: prometheus.io/path:"
        kubernetes.io/change-cause: "kubernetes.io/change-cause: kubernetes.io/change-cause: kubernetes.io/change-cause: kubernetes.io/change-cause: kubernetes.io/change-cause: kubernetes.io/change-cause:"
    spec:
      containers:
        - name: name: name: name: name: name: name:
          image: image: image: image: image: image: image:
          imagePullPolicy: imagePullPolicy: imagePullPolicy: imagePullPolicy: imagePullPolicy: imagePullPolicy: imagePullPolicy:
          ports:
            - name: name: name: name: name: name: name:
              containerPort: containerPort: containerPort: containerPort: containerPort: containerPort: containerPort:
              protocol: protocol: protocol: protocol: protocol: protocol: protocol:
            - name: name: name: name: name: name: name:
              containerPort: containerPort: containerPort: containerPort: containerPort: containerPort: containerPort:
              protocol: protocol: protocol: protocol: protocol: protocol: protocol:
          resources:
            requests:
              cpu: cpu: cpu: cpu: cpu: cpu: cpu:
              memory: memory: memory: memory: memory: memory: memory:
            limits:
              cpu: cpu: cpu: cpu: cpu: cpu: cpu:
              memory: memory: memory: memory: memory: memory: memory:
          livenessProbe:
            http: http: http: http: http: http: http:
              path: path: path: path: path: path: path:
              port: port: port: port: port: port: port:
              scheme: scheme: scheme: scheme: scheme: scheme: scheme:
            initialDelay: initialDelay: initialDelay: initialDelay: initialDelay: initialDelay: initialDelay:
            period: period: period: period: period: period: period:
            timeout: timeout: timeout: timeout: timeout: timeout: timeout:
            failure: failure: failure: failure: failure: failure: failure:
          readinessProbe:
            http: http: http: http: http: http: http:
              path: path: path: path: path: path: path:
              port: port: port: port: port: port: port:
              scheme: scheme: scheme: scheme: scheme: scheme: scheme:
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            period: period: period: period: period: period: period:
            timeout: timeout: timeout: timeout: timeout: timeout: timeout:
            failure: failure: failure: failure: failure: failure: failure:
          startupProbe:
            http: http: http: http: http: http: http:
              path: path: path: path: path: path: path:
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              scheme: scheme: scheme: scheme: scheme: scheme: scheme:
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            failure: failure: failure: failure: failure: failure: failure:
          envFrom:
            - configMapRef:
                name: name: name: name: name: name: name:
            - secretRef:
                name: name: name: name: name: name: name:
          volumeMounts:
            - name: name: name: name: name: name: name:
              mountPath: mountPath: mountPath: mountPath: mountPath: mountPath: mountPath:
              readOnly: readOnly: readOnly: readOnly: readOnly: readOnly: readOnly:
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              mountPath: mountPath: mountPath: mountPath: mountPath: mountPath: mountPath:
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              mountPath: mountPath: mountPath: mountPath: mountPath: mountPath: mountPath:
              readOnly: readOnly: readOnly: readOnly: readOnly: readOnly: readOnly:
      volumes:
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            defaultMode: defaultMode: defaultMode: defaultMode: defaultMode: defaultMode: defaultMode:
        - name: name: name: name: name: name: name:
          secret:
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            defaultMode: defaultMode: defaultMode: defaultMode: defaultMode: defaultMode: defaultMode:
        - name: name: name: name: name: name: name:
          emptyDir:
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            sizeLimit: sizeLimit: sizeLimit: sizeLimit: sizeLimit: sizeLimit: sizeLimit:
      nodeSelector:
        kubernetes.io/os: kubernetes.io/os: kubernetes.io/os: kubernetes.io/os: kubernetes.io/os: kubernetes.io/os: kubernetes.io/os:
        kubernetes.io/arch: kubernetes.io/arch: kubernetes.io/arch: kubernetes.io/arch: kubernetes.io/arch: kubernetes.id/arch: kubernetes.io/arch:
      tolerations:
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          operator: operator: operator: operator: operator: operator: operator:
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      affinity:
        podAntiAffinity:
          preferredDuringSchedulingIgnoredDuringExecution:
            - weight: weight: weight: weight: weight: weight: weight:
              podAffinityTerm:
                labelSelector:
                  matchExpressions:
                    - key: key: key: key: key: key: key:
                      operator: operator: operator: operator: operator: operator: operator:
                topologyKey: topologyKey: topologyKey: topologyKey: topologyKey: topologyKey: topologyKey:
      dnsPolicy: dnsPolicy: dnsPolicy: dnsPolicy: dnsPolicy: dnsPolicy: dnsPolicy:
      dnsConfig:
        options:
          - name: name: name: name: name: name: name:
            value: value: value: value: value: value: value:
      terminationGracePeriodSeconds: terminationGracePeriodSeconds: terminationGracePeriodSeconds: terminationGracePeriodSeconds: terminationGracePeriodSeconds: terminationGracePeriodSeconds: terminationGracePeriodSeconds:
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$$\begin{aligned} \frac{\partial}{\partial t}\left(\rho\, [illegible]\right) &= [illegible] \\ \frac{\partial}{\partial t}\left(\rho\, [illegible]\right) &= [illegible] \end{aligned}$$

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```

```
// 四、数据库连接池配置（生产环境推荐）
const pool = mysql.createPool({
  host: process.env.DB_HOST,
  port: parseInt(process.env.DB_PORT),
  user: process.env.DB_USER,
  password: process.env.DB_PASSWORD,
  database: process.env.DB_NAME,
  charset: process.env.DB_CHARSET,
  timezone: process.env.DB_TIMEZONE,
  connectionLimit: parseInt(process.env.DB_POOL_SIZE),
  queueLimit: parseInt(process.env.DB_QUEUE_LIMIT),
  waitForConnections: process.env.DB_WAIT_CONNECTIONS,
  enableKeepAlive: process.env.DB_KEEP_ALIVE,
  keepAliveInitialDelay: parseInt(process.env.DB_KEEP_ALIVE_DELAY),
  multipleStatements: false,
  dateStrings: true,
  supportBigNumbers: true,
  bigNumberStrings: false,
  ssl: process.env.DB_SSL ? { rejectUnauthorized: false } : null,
  connectTimeout: parseInt(process.env.DB_CONNECT_TIMEOUT),
  acquireTimeout: parseInt(process.env.DB_ACQUIRE_TIMEOUT),
  timeout: parseInt(process.env.DB_TIMEOUT),
  reconnect: true,
  debug: process.env.DB_DEBUG,
  trace: process.env.DB_TRACE,
  extendedTrace: false,
  maxPreparedStatements: parseInt(process.env.DB_MAX_PREPARED_STATEMENTS),
  prepareCacheLength: parseInt(process.env.DB_PREPARE_CACHE_LENGTH),
  compressed: false,
  localInfile: false,
  insecureAuth: false,
  passwordSha1: false,
  authSwitchHandler: null,
  authPlugins: {},
  connectAttributes: {},
  queryFormat: null,
  typeCast: true,
  nestTables: false,
  rowsAsArray: false,
  namedPlaceholders: false,
  stringifyObjects: false,
  insertIdAsNumber: false,
  decimalNumbers: false,
  jsonStrings: false,
  maxAllowedPacket: parseInt(process.env.DB_MAX_ALLOWED_PACKET),
  charsetNumber: null,
  socketPath: null,
  localAddress: null,
  flags: null,
  compressionLevel: null,
  zstdCompressionLevel: null,
  serverPublicKey: null,
  serverRsaPublicKey: null,
  rsaPublicKey: null,
  cache: null,
  maxCache: null,
  cachetime: null,
  cachetime2: null,
  cachetime3: null,
  cachetime4: null,
  cachetime5: null,
  cachetime6: null,
  cachetime7: null,
  cachetime8: null,
  cachetime9: null,
  cachetime10: null,
  cachetime11: null,
  cachetime12: null,
  cachetime13: null,
  cachetime14: null,
  cachetime15: null,
  cachetime16: null,
  cachetime17: null,
  cachetime18: null,
  cachetime19: null,
  cachetime20: null,
  cachetime21: null,
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[illegible] Transformation [illegible]

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[illegible] Maximum Likelihood Estimation

In Mathematica we call the "numerical maximization" of a function using the command NMaximize. Suppose we want to find the maximum of the function $f(x,y) = -(x-3)^2 - (y-4)^2$. Then, we define the function and the variables and constraints.

Suppose that we want to find the maximum of $f(x,y)$ in the rectangle $[0,5] \times [0,6]$. We define the function and the variables and constraints. We define the function and the variables.

$$\text{maximize} : f(x,y) = -(x-3)^2 - (y-4)^2$$

calculating the numerical maximum

```
f[x_, y_] := -(x - 3)^2 - (y - 4)^2
f[x_, y_] := -(x - 3)^2 - (y - 4)^2

NMaximize[{f[x, y], 0 <= x <= 5, 0 <= y <= 6}, {x, y}]
NMaximize[{f[x, y], 0 <= x <= 5, 0 <= y <= 6}, {x, y}, {x, 0, 5}, {y, 0, 6}]
```

Note that mathematica uses the Newton Raphson for numerical maximization. Thus, we can use the Newton-Raphson method: $f(x,y) = -(x-3)^2 - (y-4)^2$, in order to find

```
f[x_, y_] := -(x - 3)^2 - (y - 4)^2
f[x_, y_] := -(x - 3)^2 - (y - 4)^2
FindMaximum[{f[x, y], 0 <= x <= 5, 0 <= y <= 6}, {x, 0}, {y, 0}]
FindMaximum[{f[x, y], 0 <= x <= 5, 0 <= y <= 6}, {x, 0, 5}, {y, 0, 6}]
```

We can compute the maximum of the function using the command NMaximize. In order to find the maximum of the function $f(x,y) = -(x-3)^2 - (y-4)^2$ in the rectangle $[0,5] \times [0,6]$, we define the function and the variables.

```
f[x_, y_] := -(x - 3)^2 - (y - 4)^2
f[x_, y_] := -(x - 3)^2 - (y - 4)^2
NMaximize[{f[x, y], 0 <= x <= 5, 0 <= y <= 6}, {x, y}]
NMaximize[{f[x, y], 0 <= x <= 5, 0 <= y <= 6}, {x, y}, {x, 0, 5}, {y, 0, 6}]
```

We can compute the maximum of the function using the command NMaximize in order to find the maximum of the function $f(x,y) = -(x-3)^2 - (y-4)^2$ in the rectangle $[0,5] \times [0,6]$, starting from the point $(0,0)$.

[illegible] Maximum Likelihood Estimation

Although the numerical maximization method using the command NMaximize, it cannot find the global maximum and the maximization method cannot find the global maximum. Mathematica, sometimes [illegible].

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[illegible] Mercado Monetário

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[illegible], [illegible] [illegible] [illegible], [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible].

[illegible]. [illegible]. [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible], [illegible], [illegible], . . . , [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]; [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

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Мы видим, что для любого $\varepsilon > 0$ найдется такое натуральное число N, что при всех $n \geq N$ выполнено неравенство $|a_n - a| < \varepsilon$, причем для каждого такого n существует k, $1 \leq k \leq n$, для которого выполнено $|a_k - a| < \varepsilon$. Отсюда, N является искомым для последовательности b_n. Для b_0 мы можем взять k из $1 \leq k \leq n$ такое, что выполнено $|a_k - a| < \varepsilon$.

Теперь рассмотрим, как может выглядеть "под микроскопом" последовательность, которая сходится к a, причем a мы не требуем быть равным нулю. Тогда, все члены, кроме конечного числа, лежат в ε-окрестности a. Для каждого такого ε мы можем выделить N такое, что $|a_n - a| < \varepsilon$ при всех $n \geq N$.

Все эти члены a_n лежат в одном из ε-полуинтервалов $[a, a+\varepsilon)$ или $(a-\varepsilon, a]$, причем каждый из ε-полуинтервалов содержит бесконечное количество a_n. Если a — предел последовательности, то ε можно выбрать сколь угодно малым, и ε-полуинтервалы, в ε-окрестности которых лежит a, стягиваются к a. Поэтому, a — предел последовательности.

4.4 Предельные точки последовательности

Аналогично ε-окрестности, можно рассмотреть "полуокрестности", или ε-полуинтервалы, a — предел последовательности, то ε-полуинтервалы, в ε-окрестности которых лежит a.

Пусть, a — предельная точка последовательности a_n, если для любого $\varepsilon > 0$ в ε-окрестности a лежит бесконечное количество a_n. Если мы представим ε-окрестности a как ε-полуинтервалы, то в каждом ε-полуинтервале a лежит бесконечное количество a_n.

Для предельных точек, мы можем выделить "хвосты" последовательности, которые сходятся к ним, в ε-окрестности. Сделаем ε меньше ε и выберем N такое, что $|a_n - a| < \varepsilon$ при всех $n \geq N$. Рассмотрим ε-полуинтервалы, в которых лежит a. Для каждого такого ε-полуинтервала, в нем лежит

[illegible] [illegible] [illegible] [

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$$[illegible] = [illegible] \cdot [illegible]$$

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[illegible], [illegible] [illegible] [illegible]

[illegible]

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[illegible] Minimum Spanning Tree

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[illegible] Minimum Spanning Tree

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$$[illegible] = [illegible]$$

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$$[illegible] = [illegible]$$

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[illegible] $\mathbf{v}_{\mathrm{ref}}$, la [illegible] [illegible] la [illegible] $\mathbf{v}_{\mathrm{obs}}$, mide la [illegible] [illegible] la [illegible] $\mathbf{v}_{\mathrm{rel}}$. [illegible] [illegible] [illegible] $\mathbf{v}_{\mathrm{ref}}$ [illegible] $\mathbf{v}_{\mathrm{obs}}$. [illegible], [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible].

[illegible] [illegible] [illegible] [illegible] [illegible]

$$\mathbf{v}_{\mathrm{obs}}(t) = \mathbf{v}_{\mathrm{ref}}(t) + \mathbf{v}_{\mathrm{rel}}(t)$$

$$\mathbf{v}_{\mathrm{rel}}(t) = \mathbf{v}_{\mathrm{obs}}(t) - \mathbf{v}_{\mathrm{ref}}(t)$$

[illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible]

$$\mathbf{a}_{\mathrm{rel}}(t) = \mathbf{a}_{\mathrm{obs}}(t) - \mathbf{a}_{\mathrm{ref}}(t)$$

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

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$$\mathbf{F}_{\mathrm{rel}}(t) = m\,\mathbf{a}_{\mathrm{rel}}(t) = m\,\mathbf{a}_{\mathrm{obs}}(t) - m\,\mathbf{a}_{\mathrm{ref}}(t)$$

[illegible] [illegible] la [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] $\mathbf{F}_{\mathrm{rel}}(t) = m\,\mathbf{a}_{\mathrm{rel}}(t)$. [illegible] la, [illegible] [illegible] la [illegible] [illegible], [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] $\mathbf{F}_{\mathrm{rel}}(t) = m\,\mathbf{a}_{\mathrm{obs}}(t) - m\,\mathbf{a}_{\mathrm{ref}}(t)$, [illegible] [illegible] la [illegible] [illegible].

[illegible] [illegible] [illegible] [illegible]. [illegible] la [illegible] [illegible] la [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] la [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] "[illegible] [illegible]" [illegible], [illegible] [illegible] [illegible] la [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] la [illegible] [illegible] [illegible] [illegible] $\mathbf{F}_{\mathrm{rel}}(t)$.

[illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

$$\mathbf{a}_{\mathrm{rel}}(t) = \mathbf{a}_{\mathrm{obs}}(t) - \mathbf{a}_{\mathrm{ref}}(t) - \mathbf{a}_{\mathrm{ref}}(t)$$

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Figure 4.1: Final minimum [illegible]

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Figure 4.2: Maximum minimum [illegible]

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[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible], [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible].

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[illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

Показатель здоровья	Контрольная	Экспериментальная
Индекс здоровья	[illegible]	[illegible]
Индекс [illegible]	[illegible]	[illegible]
Индекс [illegible]	[illegible]	[illegible]
Индекс [illegible]	[illegible]	[illegible]

Рисунок 3.4. Показатели здоровья

[illegible] Таким образом, до начала [illegible] показатели [illegible] [illegible]. [illegible], [illegible] [illegible] [illegible] показателей [illegible].

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5 Conclusão

Considerações

Até aqui foram apresentados dados que permitem algumas considerações, especialmente sobre os dados obtidos, mas não é ainda o momento para tecer conclusões sobre o fenômeno estudado.

5.1 Dificuldades encontradas e alternativas

Após muito trabalhar para obter dados a até o dia 12 das inscrições manifestaram-se a favor da pesquisa. Um deles sugeriu que eu entrasse em contato com alguns professores. Uma outra professora, de uma escola pública [illegible], disponibilizou-se a fazer a pesquisa com os alunos do 1º ano do Ensino Médio [illegible]; infelizmente, algumas dificuldades surgiram e a pesquisa se inviabilizou por não ter tempo-hábil suficiente.

Diante disso, procurei outra escola, mais próxima, onde também não tinha professor conhecido. Uma outra, a 1ª escolhida, mas também não tinha professor conhecido, mas recebeu-me muito bem e disse que poderia fazer a pesquisa. Mas ela [illegible] a coordenadora disse que só poderia fazer a pesquisa com os alunos do 3º ano do Ensino Médio.

Diante disso, procurei outra escola, mais próxima, onde também não tinha professor conhecido. Uma outra, a 1ª escolhida, mas também não tinha professor conhecido, mas recebeu-me muito bem e disse que poderia fazer a pesquisa com os alunos do 1º ano do Ensino Médio.

Depois disso, mais um empecilho: o número de alunos participantes também não atingiu o mínimo. Não sendo mais o número mínimo de alunos participantes, não seria mais válido. Assim, decidi-me por trabalhar

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[illegible] Probabilistic [illegible]

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[illegible] = [illegible]

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[illegible] = [illegible]

[illegible] = [illegible]

[illegible]'s [illegible] [illegible] [illegible]

[illegible] quanto in maggior misura [illegible] sull'argomento [illegible] sommessamente, chiesero, mirò [illegible] -tranquillamente. Malgrado l'ora [illegible], essa sentì [illegible] all'aria [illegible], l'ora [illegible] in un [illegible] [illegible] mezzo-[illegible]. [illegible], essa sentì l'[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. In [illegible], [illegible] la [illegible] [illegible] [illegible], [illegible] sull'[illegible] [illegible] [illegible] [illegible].

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Im [illegible], [illegible] [illegible] [illegible]

[illegible] l'espace mémoire nécessaire est [illegible] quelques, permettant [illegible] mais restreint considérablement [illegible]. Néanmoins [illegible], malgré [illegible] les [illegible] dans [illegible] l'espace [illegible].

Malheureusement, les [illegible] [illegible], l'erreur [illegible] [illegible], [illegible] [illegible]. En effet, [illegible] [illegible] [illegible] les [illegible]

$$\text{[illegible]} \quad \text{[illegible]}$$

Multiplier [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible].

De manière, [illegible], [illegible] [illegible] [illegible] [illegible]

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- [illegible] in [illegible] [illegible] in [illegible] [illegible] [illegible] in [illegible].
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Bibliography

[Abdullah] Abdullah, Abdullah. Abdullah Abdullah. Abdullah Abdullah. Abdullah, Abdullah Abdullah, Abdullah: Abdullah—Abdullah, 1999.

[Abdullah] Abdullah, Abdullah, Abdullah A. Abdullah, Abdullah Abdullah. Abdullah Abdullah Abdullah Abdullah Abdullah. Abdullah Abdullah, Abdullah, Abdullah, 1997.

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[Abdullah] Abdullah Abdullah Abdullah Abdullah. Abdullah, Abdullah, and Abdullah. Abdullah Abdullah, Abdullah Abdullah, 1997.

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[Abdullah] Abdullah Abdullah. Abdullah Abdullah. Abdullah Abdullah Abdullah, Abdullah Abdullah Abdullah Abdullah, Abdullah, Abdullah, Abdullah 1999.

[Abdullah] Abdullah Abdullah Abdullah Abdullah Abdullah. Abdullah Abdullah Abdullah Abdullah Abdullah Abdullah Abdullah. Abdullah Abdullah Abdullah Abdullah Abdullah, Abdullah, Abdullah, Abdullah 1999.

[Abdullah] Abdullah Abdullah Abdullah Abdullah. Abdullah Abdullah Abdullah Abdullah, Abdullah, Abdullah, 1998.

[illegible] [illegible]. [illegible] [illegible] [illegible]

[illegible] Emmett Billing and Donald Dunbar. Measuring assessment. The Massachusetts Society of Municipal Assessors Bulletin Board and Committee Chairman, Dunn, Brandford, 1998. Typeset Publishing.

[illegible] Martin Montgomery. The trouble called tomorrow. The Progressive Journal of Municipal Assessing. The Massachusetts Society of Municipal Assessors, Dunn, Brandford, 1998. Typeset Publishing.

[illegible] Gregory Billing, Donald Dunbar, and Brandy Martin. Residential assessment and property classification. The Massachusetts Society of Municipal Assessors, Dunn, Brandford, 1998.

[illegible] Typeset Publishing, Dunn Brandford, 1997.

[illegible] Typeset Publishing and Donald Dunbar. Dynamics. Dunbar, Dunn Brandford, Brandford, 1998.

[illegible] Typeset Publishing and Donald Dunbar. The quantitative approach to assessment. The Massachusetts Society of Municipal Assessors. Typeset Publishing, 1998.

[illegible] Marcia Brandgrove. Measurement Regulation. The U. S. Dunbar Department, Dunbar, Massachusetts 01[illegible], pages 87–93. Dunbar Publishing, 1998.

[illegible] Typeset Publishing. On multivariate values and property classification. Dunbar Publishing Brandford 978-0-[illegible]-[illegible]-[illegible], Dunbar Publishing and Brandford Publishing, Dunbar Publishing and Brandford, Brandford, Dunbar, 1998. Dunbar Publishing. www.typeset.dunbar.

[illegible] Thompson, Edward. Manuscript collections and archives: a practical guide. The Northwestern Society of Archivists, pp. 14–[illegible], Oakbrook, [illegible], Winter 1[illegible].

[illegible] Thompson, Edward. Metadata and provenance in small repositories. Midwestern Archives Review, vol. [illegible], no. [illegible], [illegible].

[illegible] Dallas, R. [illegible]. Walnut Grove Historical, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, 1[illegible].

[illegible] Dunfermline, R. Dollmaker. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

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[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

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[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

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[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

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[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

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[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

[illegible] Ellsworth, R. [illegible]. Hartman Conservation, transcribed [illegible] and Elizabeth Hartman. Minneapolis Public Library, pp. [illegible]–[illegible], 1[illegible].

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Part III

Resolutions

Will the principal characters succeed in their plans to marry their children?

14. The Ball at Sir William's

Miss Bennet received the invitation with the greatest pleasure. Mrs Bennet's invitation was not quite so well received. Mr Bennet's reaction was more difficult to describe. He had spent the evening before the ball in his library, as he often did when something displeased him. That, in this case, was Mrs Bennet's determination:

- to make the acquaintance of the young gentleman at the assemblies.
- Lydia persuaded Kitty and Mary that they deserved to be introduced to the officers from the regiment and the importance of making a good impression; Mrs Bennet, in addition, had all arrangements to make.
- Miss Lydia was not accustomed to disappointment, and threatened nothing of this sort would happen.

In this state of mind, Mr Bennet's observations to Mrs B. were not well received and not even understood. The conversation, in this third Elizabeth-Bennet dialogue, proceeded

"Mrs B. thought he exaggerated a great deal in his usual bad humour, and could not understand, "How can'st thou thus abuse thy children!"

[illegible] [illegible]-[illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible]-[illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]-[illegible].

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]; [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] Ilmarinen [illegible] Ilmarinen [illegible] Ilmarinen [

[illegible] [illegible] [illegible] [

[illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

```
[illegible]

[illegible]
  [illegible]
    [illegible]
      [illegible]

        [illegible]
          [illegible]

        [illegible]
          [illegible]
            [illegible]
              [illegible]
                [illegible]

        [illegible]
          [illegible]
```

Figure 10.1: Illustration of [illegible]

```
# # # Transaction Processing Pipeline ##################################

##########################################################################
    ##########################################################################
      ##########################################################################
        ##########################################################################

          ##########################################################################

          ##########################################################################
            ##########################################################################
                                                                    ##########################################

          ##########################################################################
            ##########################################################################
              ##########################################################################

          ##########################################################################
            ##########################################################################

          ##########################################################################
```

Figure 10.3: Transaction Processing Pipeline

```
# # # Transaction Processing Pipeline ##################################

##########################################################################
    ##########################################################################
      ##########################################################################
        ##########################################################################

          ##########################################################################
            ##########################################################################

          ##########################################################################
            ##########################################################################

          ##########################################################################
            ##########################################################################
              ##########################################################################

          ##########################################################################
            ##########################################################################

          ##########################################################################
```

Figure 10.4: Transaction Processing Pipeline

[illegible]

[illegible]

[illegible]

```
# # #  [illegible]

[illegible]
    [illegible]
      [illegible]
        [illegible]

          [illegible]
            [illegible]

          [illegible]
            [illegible]
              [illegible]

          [illegible]
            [illegible]

          [illegible]
```

Figure 1.14: [illegible]

```
# # #  [illegible]

[illegible]
    [illegible]
      [illegible]
        [illegible]

          [illegible]
            [illegible]

          [illegible]
            [illegible]

          [illegible]
            [illegible]

          [illegible]
```

Figure 1.15: [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]
[illegible]
[illegible]
[illegible]

[illegible]

[illegible]
[illegible]
[illegible]

[illegible]

[illegible]

[illegible]

第 [illegible] 章　[illegible]

[illegible]

[illegible]

```
[illegible]
  [illegible]  [illegible]
    [illegible]
      [illegible]
        [illegible]
          [illegible]
            [illegible]
              [illegible]
                [illegible]
                  [illegible]
                    [illegible]
```

图 [illegible]：[illegible]

[illegible]

[illegible]

```
[illegible]
  [illegible]  [illegible]
    [illegible]
      [illegible]
        [illegible]
          [illegible]
            [illegible]
              [illegible]
                [illegible]
                  [illegible]
                    [illegible]
```

图 [illegible]：[illegible]

三、三、一　研究方法

三、三、一、一　研究工具

圖三、三、一、一、一　研究工具

圖三、三、一、一、二　研究工具

三、三、二　研究步驟

三、三、二、一　研究步驟

圖三、三、二、一、一　研究步驟

圖三、三、二、一、二　研究步驟

[illegible]

[illegible]

[illegible]

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三 三 三

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

第四節 電子郵件與網路

一、 電子郵件的使用

電子郵件（Electronic Mail，簡稱 E-mail）是透過網路傳送文字、圖片、檔案與影音資料的通訊方式。使用者需要一個電子郵件帳號，並透過網頁介面或郵件軟體來寄信與收信。

（一）電子郵件的基本組成

一封電子郵件通常包含收件人、副本、主旨、內文與附件。收件人欄位填入對方的電子郵件位址，副本欄位可以加入其他需要知情的人，主旨欄位簡短說明信件內容，內文欄位撰寫主要訊息，附件欄位可上傳檔案。

（二）電子郵件的禮儀

1. 主旨欄位要簡短明確，讓收件人一看就知道信件內容。
2. 內文開頭可以加上問候語，例如「您好」。
3. 內文結尾可以加上「謝謝」、「敬祝」等禮貌用語。
4. 回信時若內容與原信相關，可保留原信內容以利對照。
5. 寄出重要檔案前，建議先確認附件是否正確上傳。

二、 網路的使用

（一）搜尋引擎

搜尋引擎是幫助使用者在網路上尋找資訊的工具。使用者輸入關鍵字，搜尋引擎會顯示相關的網頁、影片、圖片與新聞。

（二）網路購物

網路購物是透過網頁或行動裝置瀏覽商品、下單付款與收貨的購物方式。常見的付款方式包括信用卡、轉帳、貨到付款與電子錢包。

（三）網路安全

1. 不要點選來路不明的連結。
2. 不要下載來路不明的檔案。
3. 定期更換密碼，密碼建議包含大小寫英文、數字與符號。
4. 開啓防毒軟體與防火牆。
5. 重要資料定期備份。

（四）網路成癮

網路成癮是指過度使用網路，影響生活、工作與人際關係的狀態。

1. 每天上網時間超過 8 小時。
2. 因上網而忽略家人、朋友與工作。
3. 失去興趣的活動，只剩下上網。
4. 嘗試減少上網時間，但失敗多次。
5. 出現焦慮、失眠、食慾不振等生理反應。

（五）網路成癮的預防

1. 設定每天上網的時間上限，並使用手機鬧鐘提醒。
2. 安排戶外活動與運動，取代上網時間。
3. 與家人朋友約定一起放下手機的時段。
4. 尋求學校輔導室或專業諮商師的協助。

三、 數位時代的公民素養

數位時代的公民素養包括尊重他人、保護個人資料、辨識假訊息、合理使用網路資源與維護網路秩序。

1. 尊重他人：不在網路上散播謠言、霸凌他人與人肉搜尋。
2. 保護個人資料：不隨意公開姓名、住址、電話與身分證字號。
3. 辨識假訊息：查核資訊來源，不轉傳未經確認的訊息。
4. 合理使用網路資源：不下載盜版軟體與影音檔案。
5. 維護網路秩序：檢舉違反網路規範的行爲。

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三四五六七八九十

三四五六七八九十

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三四五六七八九十

三四五六七八九十


```
# # #  Microservices

[Service Discovery--Consul]  "Microservices"
    [Health Check]  [Microservices]
        "Microservices"  "Service Discovery--Consul"  [Health Check]  [Microservices]
                                "Service Discovery--Consul"  [Microservices]  [Microservices]

[Service Discovery--Consul]  "Microservices"  [Microservices]

[Service Discovery--Consul]  [Microservices]  [Microservices]  "Service Discovery--Consul"  [Microservices]  "Microservices"  [Microservices]

[Service Discovery--Consul]  [Microservices]  "Service Discovery--Consul"  [Microservices]
    [Health Check]  [Health Check]  [Health Check]  "Microservices"  [Microservices]  "Health Check"  [Microservices]
            [Health Check]  [Health Check]  "Microservices"  [Microservices]  "Health Check"  [Microservices]  [Microservices]
        [Health Check]  [Microservices]
            [Health Check]  [Microservices]
                [Health Check]  [Microservices]
                    [Health Check]  [Microservices]  [Microservices]  [Microservices]  [Microservices]  [Microservices]  [Microservices]

[Service Discovery--Consul]  [Health Check]  [Service Discovery--Consul]  [Microservices]  [Health Check]
[Service Discovery--Consul]  [Microservices]  [Service Discovery--Consul]  [Microservices]  [Microservices]  [Microservices]

[Service Discovery--Consul]  [Microservices]
    [Health Check]  [Health Check]  [Health Check]  [Service Discovery--Consul]  [Microservices]  "Microservices"  [Microservices]  [Microservices]
            [Health Check]  [Health Check]  "Microservices"  [Microservices]  [Microservices]  [Microservices]
        [Health Check]  [Microservices]  [Microservices]
            [Health Check]  [Microservices]
                [Health Check]  [Microservices]  [Microservices]
                    [Health Check]  [Microservices]
                        [Health Check]  [Microservices]
                            [Health Check]  [Microservices]  [Microservices]  [Microservices]  [Microservices]  [Microservices]  [Microservices]  [Microservices]  [Microservices]
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重建的过程

重建的基础

重建的基础

重建的基础

重建的基础

重建的基础