6.2 Toolkit: quantitative tools and Paper 3 planning

Name: _____ Class: _____ Date: _____ **Total: 30 marks**

KEY WORDS decision tree • expected value • critical path • total float • Gantt chart • social enterprise

Objective

Build the skills to use the **quantitative tools** of the toolkit (decision trees, **critical path analysis** , Gantt charts, simple linear regression) and to plan a Paper 3 answer for a **social enterprise** .

You must be able to:

- construct a decision tree and calculate expected values
- construct a network, find the critical path and calculate float; read a Gantt chart
- interpret simple linear regression: the line of best fit, correlation and its limits
- plan and write a Paper 3 answer: human need, problem, options, tools, stakeholders and a costed plan

1 Key knowledge and worked examples

Quantitative tools

Decision tree: a square is a decision; a circle is a chance node with probabilities that add to 1. **Expected value** $= \sum$(probability $\times$ outcome). Net gain = expected value − cost. Choose the option with the highest net gain, but remember that probabilities and outcomes are estimates.

Critical path analysis (CPA): shows the order and length of the activities in a project. The **critical path** is the longest path through the network: any delay to an activity on it delays the whole project. **Earliest start time (EST)** and **latest finish time (LFT)** are written in each node. **Total float** = LFT − duration − EST: how long an activity can be delayed without delaying the project (zero on the critical path).

Gantt chart: a bar for each activity against time; easy to read and to track progress, but it does not show dependencies as clearly as a network.

Simple linear regression: a line of best fit through data (e.g. advertising spend against sales) used to predict one variable from another. A strong correlation does not prove cause, and predictions outside the data range are unreliable.

Paper 3: planning for a social enterprise

Paper 3 gives resources about a **social enterprise** (for-profit or non-profit) and asks you to identify a **human need**, a **problem** the enterprise faces, and to recommend a **plan of action**.

1. state the **human need** it serves and the main **problem** (e.g. falling funding);
2. use **data** from every resource; use **two or more tools** (SWOT, STEEPLE, force field, decision tree, Gantt);
3. compare **options**, with costs and risks;
4. consider **stakeholders** and ethics;
5. give a clear, **realistic plan**: who does what, when, at what cost, and how it is funded;
6. finish with a **justified conclusion**.

Answer shapes: draw the tree or network neatly → show every calculation → state the decision → note the limits of the tool.

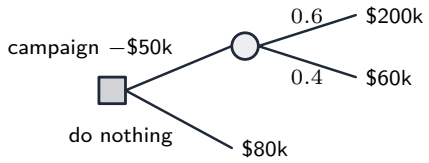
2 Practice

2.1 In a decision tree, distinguish between a decision node and a chance node. [2]

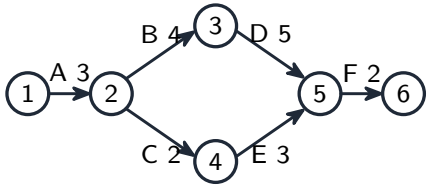


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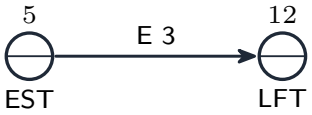
2.2 A firm can launch a campaign costing \$50,000: with probability 0.6 it brings revenue of \$200,000, and with probability 0.4 revenue of \$60,000. Or it can do nothing and earn \$80,000. Calculate the net expected value of the campaign and state the better option. [4]



2.3 Using the network, identify the critical path and the minimum project duration. [4]



2.4 Calculate the total float of activity E, and explain what it means. [3]



3 Exam-style questions

3.1 Bright Futures is a non-profit social enterprise in a large city. It runs free after-school coding classes for 200 teenagers from low-income families each year. Its resources are summarized below. Government grants will fall, and the board must decide how to keep the classes running.

item	now	next year
government grants	\$120 000	\$80 000
donations	\$15 000	\$15 000
staff costs	\$90 000	\$90 000
rent and laptops	\$30 000	\$30 000
students per year	200	200
volunteer mentors	25	30
classrooms used in evenings	2 of 6	2 of 6

Using all the information and your knowledge of business management, recommend a plan of action to ensure the sustainability of Bright Futures for the next three years. [17]

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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

decision node (square): a point where the manager chooses between options; chance node (circle): a point where outcomes depend on chance, each with a probability

2.2

expected value $= 0.6 \times 200\,000 + 0.4 \times 60\,000 = \$144\,000$; net $= 144\,000 - 50\,000 = \$\mathbf{94\,000}$; \$94,000 > \$80,000, so launch the campaign

2.3

paths: A–B–D–F $= 3+4+5+2 = 14$ days; A–C–E–F $= 3+2+3+2 = 10$ days; critical path A–B–D–F; minimum duration **14** days; any delay on A, B, D or F delays the project

2.4

EST of E $= 3+2 = 5$; F cannot start until day 12, so LFT of E $= 12$; float $= 12-3-5$ $= \mathbf{4}$ days; E can be delayed by up to 4 days without delaying the whole project

3.1

award up to [17]: identifies the human need (education and skills for low-income teenagers, a path to better jobs) and the key problem (grants falling from \$120,000 to \$80,000, so income of \$95,000 no longer covers costs of \$120,000: a gap of \$25,000 a year); uses at least two toolkit tools with data, e.g. SWOT (strengths: strong results, volunteer mentors; threats: falling grants), STEEPLE, force field, decision tree or a Gantt chart for the plan; evaluates the options with figures: corporate sponsorship from tech firms (fits the mission; risk of dependence); paid courses for adults or schools to cross-subsidize (uses spare evening capacity; needs marketing and time); a sliding-scale fee (raises revenue but may exclude the poorest, against the mission); considers stakeholders and ethics: students, families, volunteers, donors, the board; mission drift; a realistic plan with timeline, responsibilities, costs and funding over three years, e.g. year 1 sponsorship and a pilot adult course, year 2 expand paid courses, year 3 review; a justified conclusion linked to the human need

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