



KEY SKILLS APPLICATION OF NUMBER Level 4

Monday 14 November 2005

Mark Scheme

Question	Marks	For	Responses																								
1a	3 marks	3	<p>Clear, correctly labelled, complete diagram showing start and end of project, times of activities and correct order of precedence throughout. The diagram may state or imply the order of activities. Either a network diagram or flowchart eg</p> <p style="text-align: right;">Diagram not to scale</p> <p>or a Gantt chart or scheduling diagram eg</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;"></td> <td colspan="6" style="text-align: center;">Order in which activities to be undertaken</td> <td style="width: 5%;"></td> </tr> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">Start</td> <td style="text-align: center;">B(60)</td> <td style="text-align: center;">C(28)</td> <td style="text-align: center;">D(55)</td> <td style="text-align: center;">E(7)</td> <td style="text-align: center;">H(21)</td> <td style="text-align: center;">K(1)</td> <td style="text-align: center;">L(2)</td> <td rowspan="2" style="text-align: center; vertical-align: middle;">End</td> </tr> <tr> <td style="text-align: center;">A(35)</td> <td></td> <td style="text-align: center;">G(3)</td> <td></td> <td style="text-align: center;">F(1) I(7) J(4)</td> <td></td> <td></td> </tr> </table> <p>(a correct but non-optimum schedule would also be acceptable here)</p>		Order in which activities to be undertaken							Start	B(60)	C(28)	D(55)	E(7)	H(21)	K(1)	L(2)	End	A(35)		G(3)		F(1) I(7) J(4)		
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2	Good, clear, labelled diagram, but with one error or omission.																										
1	Partially correct labelled diagram with correct order of precedence seen for some activities																										
1b	2 marks	2	<p>Correct analysis seen (Critical path is BCDEHKL), resulting in 174 days and assumption that 'two activities need to be able to happen simultaneously' is recognised. Possible follow through from part a</p>																								
		1	Complete correct method but with one error or omission																								
1c	1 marks	1	<p>Correct explanation seen (B+3, H-2, J no effect because not a critical activity), resulting in 1 day extra needed for project (or 175 days). Possible follow through from part a and/or b</p>																								

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2a	2 marks	2	Valid description of changes for each sex, including at least 2 examples of quantification and reference to increased proportion of females, or similar eg Numbers of males and females have increased most years, over period males have gone up 45%, females 127% so proportion of females has increased - between 1994 & 1998 it is about 20% of total, in 1999 it jumps to 29% and reaches 31% by 2003.
		1	Some valid description of changes, including at least 1 example of quantification
2b	2 marks	2	At least 2 quantified comments, including comment on reduction in average age using median (15.6 in 1994, 15.0 in 2003 approx) or mean (15.65 in 1994 to 14.99 in 2003 approx) and further comments on changes in <15s and 16+, or analysis of spread.
		1	At least one valid quantified comment
	1 mark	1	Relates evidence to both statements eg 'there is a peak at 15 as Mode is 15 all years except 2001' and 'number of very young offenders is increasing eg <15s have increased nearly 3x over period, and now account for half of all children in secure accommodation'
2c	2 marks	2	Description of suitable chart (eg box plot, comparative bar chart or pie charts) comparing eg 1994 and 2003 OR suitable graph eg superimposed line graphs of total numbers and <15s numbers by year. Descriptions should include sufficient detail eg categories to be used, years etc
		1	Description of suitable chart/graph given but with insufficient detail
2d	2 marks	2	Sensible forecasting method used eg time series graph, average change, moving average or similar to give reasonable estimate for number of children, (eg 500 from time series graph or 420 from moving average) and valid reasoning from data to give number of places in excess of this.
		1	Complete correct method with one error or insufficient justification of estimates.
2e	1 marks	1	Valid comment on effect of rounding including example of a calculation which may have been affected eg This will affect the age distribution calculations. The mean could be greatly influenced by say an additional 5 children in the youngest or oldest categories.

3a	2 marks	2	Verifies load can be lifted by doing correct calculations for load and using formulae given eg $r=6+1.5$ gives 2.572T.
		1	Complete correct method with one minor error or omission.
	1 mark	1	Finds correct height of lift by Pythagoras, eg $1.75^2 + 8.86^2 = 10.6m$ (or less than this if height and/or width of block is taken into account)
3b	3 marks	3	Suitable presentation demonstrated eg Graph/Chart(s), table(s) or spreadsheet showing r values increasing by regular increments and corresponding L and height values, OR L values increasing by regular increments with corresponding r and height values, giving at least two examples of each value within valid range ($1.5 < r < 12.2$, $1.37 < L < 15$). [NB For checking purposes $L = 23.3025/r - 0.535$] Justification given eg 'easily understood by workers, for any distance you can quickly see the max load and height' or 'values easily calculated on spreadsheet for small increments of r or L and presented as a ready reckoner'
		2	Complete correct method with one error or omission
		1	Suitable presentation demonstrated but with insufficient use of examples and/or no justification
3c	2 marks	2	At least one advantage and disadvantage for each crane stated eg First option: Adv - able to reach further across building site and lift loads higher Disadv - capable of lifting less load for same distance r compared to present crane Second option: Adv - can lift greater load for same distance r compared to present crane Disadv - no gain on reach, or height of lift
		1	At least one advantage and one disadvantage given for either crane

4a	1 mark	1	Explanation of formula given eg 'speed =dist/time. The circumference gives distance travelled in one revolution of wheel, rate of pedalling gives number of turns of pedals per unit of time and gear ratio gives number of revs of wheel for every turn of pedals so multiplied together they give the total distance travelled per unit of time.'
	2 marks	2	Uses formula for given bike including substitution of circumference (~85" or 215cm) and gear ratio of 3 and states units used. Finds speed of ~27km/h (17mph) or equivalent.
		1	Complete correct method with one error or omission.
4b	1 mark	1	At least two valid comments eg <ul style="list-style-type: none"> • Good visual impact/helps visualisation of route • Vertical scale exaggerated compared to horizontal - could be misleading • Route length measured along horizontal not along actual route up mountains - could be misleading • More easily understood than giving data on climbs in a table or text
4c	3 marks	3	Uses length of climb given (14.1 km), finds lowest gear ratio as 1.2, and calculates speed as 9.3km/h to give time of approx 1.5 hours.
		2	Complete correct method with one error or omission
		1	Finds correct speed
4d	3 marks	3	Overall time estimate (8hrs 59 min \pm 4 min) OR average speed estimate (22.5km/h \pm 0.1km/h), based on: <ul style="list-style-type: none"> • Distance for climbs (29.8km) and speed of 9.3km/h • Suitable estimation of downhill distance (approx 50km of downhill in mountains (accept \pm5km)) and speed of 40 km/h • Remaining distance from subtraction of downhill and climbs from total distance (ie 122.1km \pm5km) and speed of 27 km/h Allow follow through from parts a and c.
		2	Complete correct method with one error or omission
		1	At least one bulleted part of method above found correctly
	1 mark	1	Comparison of total time or average speed found with silver medal time (9hrs 10min) or average speed, and statement as to possibility of achieving it (eg time estimated is 8hrs 59min so goal may be achieved). Qualifying statement that achievement is based on very broad estimates or that it doesn't include any contingency for unforeseen circumstances eg punctures etc.

5a	2 marks	2	Scattergraph of relationship between runners' heights and weights with valid scales and labels.
		1	Scattergraph with one error or omission
	1 mark	1	Valid conclusion about relationship eg 'data shows a roughly linear relationship, weight increasing with height, with the sprinters being grouped at the heavier end of the graph and two of the long distance runners being much lighter'
	2 marks	2	Comparison of given model with data by eg graphical or numerical method AND Quantified description of difference eg runners generally about 10kg lighter on average OR new model which fits athletes' data better eg First 1.5m 40kg each extra 5cm add 5kg or as equation eg $\text{Weight} = 100 \times \text{Height} - 110$
1		Comparison of given model with data and qualitative description given of difference.	
5b	2 marks	2	Suggests two hypotheses which could be tested eg <ul style="list-style-type: none"> • For each athletics event there is an ideal BMI/height/weight for athletes • Long distance runners have a smaller body size than Sprinters • Groups of similar events have the same ideal body size
		1	Suggests one valid hypothesis
5c	2 marks	2	Description of data collection, including <ul style="list-style-type: none"> • Types of data required • Identification of possible data source(s) • Method of data collection/sampling • Appreciation of quantity of data required for reliability
		1	Description of data collection including at least two of the above.
	1 mark	1	Considers alternative lines of enquiry
	2 marks	2	Reasoned selection of methods described for testing hypothesis and finding model, including <ul style="list-style-type: none"> • Collation and analysis of data • Development of model
		1	Reasoned selection of methods, including one of the above
	1 mark	1	Identifies need to monitor progress and adapt strategy as appropriate
	1 mark	1	Appreciates need to test and refine model
1 mark	1	Considers method of presentation and explanation of findings	

TOTAL MARKS FOR TEST 50