Level 3 Certificate

Mathematical Studies

1350/2B Critical Path and Risk Analysis
Final Mark scheme

1350
June 2017

Version/Stage: v1.0

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Key to mark scheme abbreviations

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
√or ft or F	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
–*x* EE	deduct *x* marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

Q	Answer	Mark	Comments
1(a)	***Errors*** Information from one operator is missing Inappropriate use of currency notation eg £189.99p with both the pence and the pounds symbol. The one-off payment for Operator D may have been wrong/possibly a decimal point is missing No time frame for rental cost/contract	E2	E1 for each valid error Ignore any extras even if not valid
	Improvement Name the operator Add information from the missing operator Remove the p sign when £ sign is used Replace the one-off payment for Operator D with a correct value/£99.99 State if the rental is per month or per year State the duration of the contracts for each operator Add more information on allowances eg minutes, texts, downloads Include a separate table for pay-as-you-go	E2	E1 for each valid suggestion for improvement Ignore any extras even if not valid Condone £99.99p
	Additional Guidance		
	Improvements are independent of errors eg information from one operator is missing, they don't have to state as improvement 'add information from missing operator'		
	Work out how much he will pay overall scores E0		

Q	Answer	Mark	Comments
1(b)	**Alternative method 1** 37.49 × 24 or 899.(…) or 37.49 × 0.7 or 26.(…)	M1	
	their 899.(…)× 0.7 or 629.(…) or their 26.(…)× 24 or 629.(…) or 629.(…)	M1	
	their 629.(…)+ 109.99 or 739.(…)	M1	
	739.82 **and** No or 739.75 **and** No	A1	AWRT 739.8 Condone 739.8

1(b)	**Alternative method 2** 37.49 × 24 or 899.(…) or 37.49 × 0.7 or 26.(…)	M1	
	their 899.(…)× 0.7 or 629.(…) or their 26.(…)× 24 or 629.(…) or 629.(…)	M1	
	700 – their 629.(…) or 70.(…) **and** compares with 109.99	M1	
	70.(…) < 109.99 **and** No	A1	

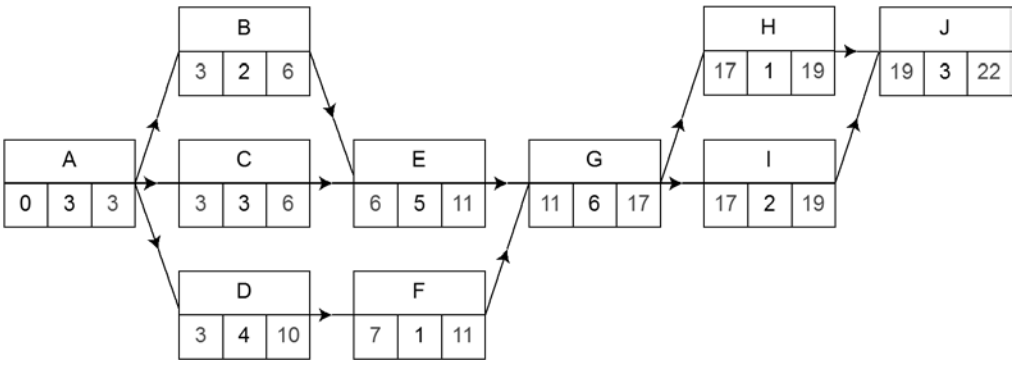
1(b)	**Alternative method 3** 700 – 109.99 or 590.01	M1	
	37.49 × 0.7 or 26.(…)	M1	
	their 590.01 ÷ their 26.(…) or 22.(…) or their 590.01 ÷ 24 or 24.(…)	M1	
	22.5 **and** No or 26.24 **and** 24.58 **and** No	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
2(a)	80 000	B1	

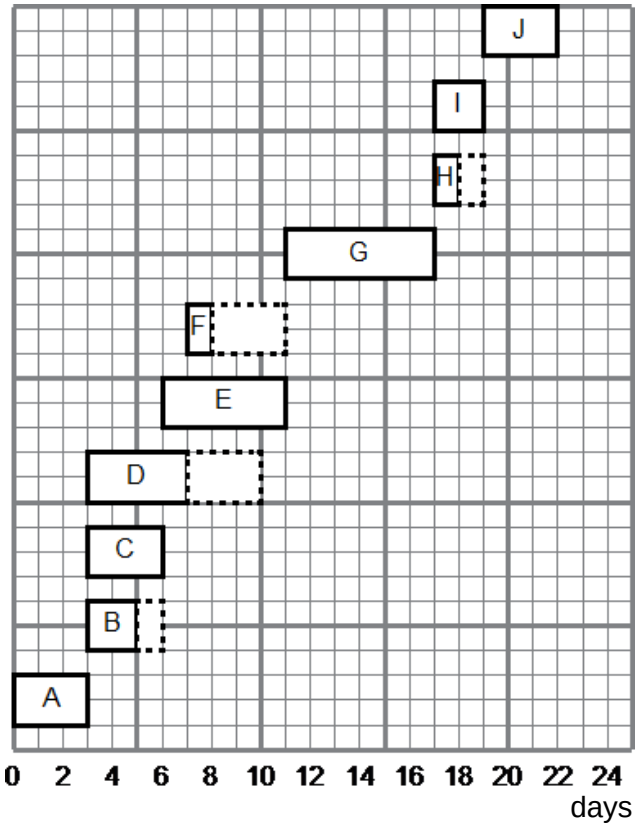
2(b)	**Always Young**		
	$\frac{16.9 - 13.7}{16.9}$ (× 100%) or $\frac{13.7}{16.9}$(×100%)**and** compares with100% or $\frac{4}{5}$ × 16.9	M1	OE SC2 for $\frac{1}{5}$ × 764 000=152800 ≠ 136000 or 764 000 – 152 800 = 611 200 ≠ 628 000 or $\frac{136\ 000}{764\ 000}$ (× 100%) = 17.8% or $\frac{628\ 000}{764\ 000}$ (× 100%) = 82.2% **and** Always Young is wrong/the statement is incorrect/it isn't quite one-fifth/ could be true it's nearly one-fifth
	[18.9,19] % or 13.5(…) **and** 13.7 seen	A1	
	Always Young is wrong or the statement/headline is incorrect or it isn't quite one-fifth or could be true it's nearly one-fifth	E1	E1 one correct statement/agreement OE
	Dynamic Youth		
	Working out the total number men 16-24 or women aged 16-24 Men: 362 000 ÷ 0.152 or Women: 265 000 ÷ 0.121	M1	This can be implied in the correct number of men/women aged 16-24 given below

	Any value within range [2 380 000, 2 400 000]	A1	
	Any value within range [2 100 000, 2 200 000]	A1	
	Putting their values as a ratio with attempts to simplify it (i.e 1.09:1 etc) or comparing it to 11:10	A1	
	Ratio of 1.09:1 calculated and Dynamic Youth is correct/the statement/headline is correct	E1	OE
	Additional Guidance		
	For Always Young, if candidates use 15.1%/12.2% leading to 19.2(...)% or 15.1%/12.3% leading to 18.5(...)% can score M1 A0 E1		

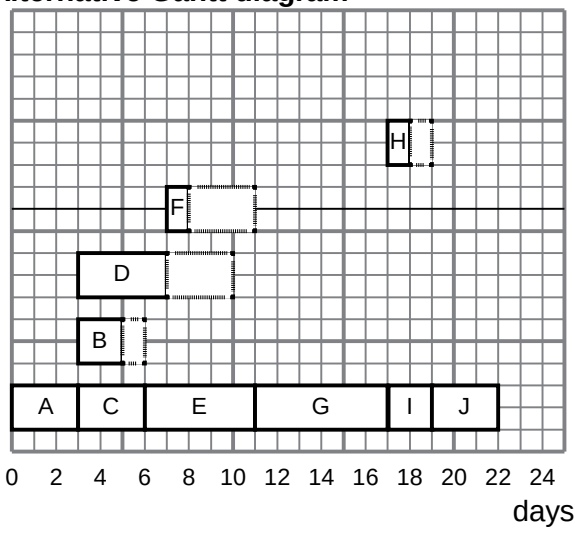
Q	Answer	Mark	Comments
2(c)	Any three of Display figures in tables e.g. give the actual figures for each quarter/year rather than the differences Ensure data is accurate before publishing it (eg for 16-24, 362 000 (men) + 265 000 (women) ≠ 628 000) Use a consistent time period throughout (eg for youth long term unemployment, the period was August – October but in all other parts of the briefing paper, references were made for September – November) Improve clarity of definitions Graph needs to be more accurate eg larger scale Sort into categories Axes need to be labelled Use more charts (to make information clearer)	E3	E1 for each valid suggestion Ignore any additional but incorrect suggestions SC1 (for two or three errors identified with no/incorrect suggestions for improvement) OE OE

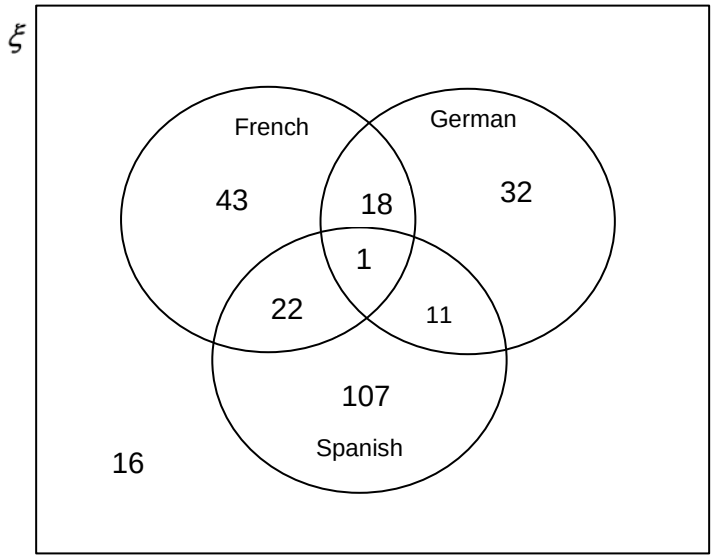
Q	Answer	Mark	Comments
3(a)	Network of at least five activities and five arcs with A, B, C and D correctly linked	B1	
	E and F only immediate predecessors of G	M1	
	Activity network correct See diagram below	A1	All boxes A to J linked correctly
	Forward pass correct as far as E **and** F	M1	
	Forward pass fully correct	A1	
	Backward pass correct as far as G	M1	
	Backward pass and durations fully correct	A1	
			
3(b)	A C E G I J	B1ft	ft their diagram
3(c)	3 (days)	B1ft	ft if non-zero

3(d)	At least 3 tasks plotted correctly with labelling and attempt at timescale on one axis	M1	Accept without floats
	Critical tasks plotted accurately	A1	(Not necessarily in a single row)
	At least 2 floats of correct duration plotted	M1 (dep)	Must have scored first M1 mark
	All correct including timescale evenly spaced and units labelled	A1	See diagram below.
Additional guidance – see diagrams on next page			



Alternative Gantt diagram

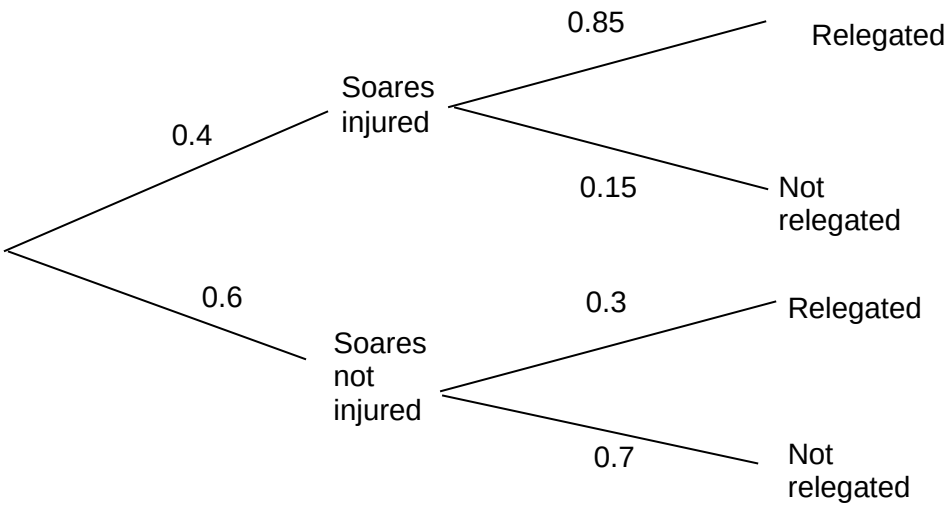


Q	Answer	Mark	Comments
4(a)	1 in correct place	B1	
	18 or 22 in correct place	B1	
	43 or 32 or 107 in correct place.	B1	
	All correct	B1	
			

Q	Answer	Mark	Comments
4(b)	$\frac{\text{their } 16}{250}$	M1	
	6.4	A1ft	Accept 6 with working ft only if working shown
4(c)	$\frac{\text{their } 43}{182}$ or $\frac{\text{their } 43}{\text{their } (43+32+107)}$	B1ft	OE fraction, decimal or percentage 0.236... or 23.6...% ft only if fraction given

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="2">5(a)</td><td>0.2 × 0.22 or 0.044</td><td>M1</td><td>May be in a table or tree diagram</td></tr>
<tr><td>4.4</td><td>A1</td><td></td></tr>
<tr><td rowspan="8">5(b)</td><td>1 – 0.2 or 0.8</td><td>M1</td><td></td></tr>
<tr><td>0.8 × 0.1 or 0.08</td><td>M1</td><td></td></tr>
<tr><td>0.08 + their 0.044 or 0.124</td><td>M1</td><td></td></tr>
<tr><td>$\frac{0.044}{0.124}$ or $\frac{\text{their } 0.044}{0.08 + \text{their } 0.044}$ or 0.35...</td><td>M1</td><td></td></tr>
<tr><td>35.5 or 35</td><td>A1ft</td><td>ft their part (a)
AWRT 35 or 35.5
$\frac{0.044}{0.044+0.1}$ or 30.6 (%) SC1
(condone 30.5 (%))</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Values may be seen in a table or tree diagram</td><td></td></tr>
<tr><td colspan="2">Example
<table><tr><td></td><td>D</td><td>D’</td><td></td></tr><tr><td>S</td><td>0.044</td><td>0.156</td><td>0.2</td></tr><tr><td>S’</td><td>0.08</td><td>0.72</td><td>0.8</td></tr><tr><td></td><td>0.124</td><td>0.876</td><td>1</td></tr></table>With no or incorrect answer</td><td>M1
M1
M1
M0
A0</td></tr>
</table>

Q	Answer	Mark	Comments
5(c)	Statement 1 is false	E1ft	ft their part b Either "true" or "false" gets B1 if consistent with their 5(b)
	Because only (their) 35% of those who get the disease are smokers	E1ft	Or 4.4 (%) compared with 8 (%) Statement 1 is true **and** Reference to their answer to 5(b) which must be over 50% SC2
	Statement 2 is true	E1	Must also refer to 10% or 22% (PI)
	Because 22% is more than twice 10%	E1	
5(d)	It would decrease	B1	

Q	Answer	Mark	Comments
Alternative method 1			
6	If Morris is signed: (E[cost] =) 0.3 × 65 (+12) or 0.3 × 77 or 23.1	M1	0.3 × 77 + 0.7 × 12 = 23.1 + 8.4 = 31.5
	(£)31.5(m)	A1	
	If Morris is not signed: P(Soares is not injured) = 0.6	B1	
	0.4 × 0.85 or 0.34 or 0.6 × 0.3 or 0.18	M1	For any of these
	0.4 × 0.85 or 0.34 **and** 0.6 × 0.3 or 0.18	M1	
	(P[relegation] =) 0.4 × 0.85 + 0.6 × 0.3 or 0.34 + 0.18 or 0.52	M1	
	(E[cost] =) 0.52 × 65 or (£)33.8(m)	A1	
	Better to sign Morris (or Yes) **and** 31.5 **and** 33.8	E1	
	Additional Guidance		
	 This tree diagram may be used to show the probabilities if Morris is not signed.		

Alternative method 2			
6	If Morris is signed: (E[cost] =) 0.3 × 65 (+12) or 0.3 × 77 or 23.1	M1	0.3 × 77 + 0.7 × 12 = 23.1 + 8.4 = 31.5
	(£)31.5(m)	A1	
	If Morris is not signed: P(Soares is not injured) = 0.6	B1	
	0.4 × 0.85 or 0.34 or 0.6 × 0.3 or 0.18	M1	For any of these
	0.4 × 0.85 × 65 or 0.34 × 65 or 22.1 or 0.6 × 0.3 × 65 or 0.18 × 65 or 11.7	M1	
	0.4 × 0.85 × 65 or 0.34 × 65 or 22.1 **and** 0.6 × 0.3 × 65 or 0.18 × 65 or 11.7	M1	
	(E[cost] =) 0.4 × 0.85 × 65 + 0.6 × 0.3 × 65 or (£)33.8(m)	A1	
	Better to sign Morris (or Yes) **and** 31.5 **and** 33.8	E1	
Alternative method 3			
	If Morris is not signed: P(Soares is not injured) = 0.6	B1	
	0.4 × 0.85 or 0.34 or 0.6 × 0.3 or 0.18	M1	For any of these
	0.4 × 0.85 or 0.34 **and** 0.6 × 0.3 or 0.18	M1	
	(P[relegation] =) 0.4 × 0.85 + 0.6 × 0.3 or 0.34 + 0.18 or 0.52	M1	
	(Improved chance of avoiding relegation by signing Morris =) 0.52 – 0.3 or 0.22	M1	

	(Expected gain from signing Morris before taking transfer fee into account) 0.22 × 65 or 14.3	A1	
	Yes **and** 14.3 compared with 12	E1	