QUESTION 1

ANSWER **2 OUT OF 3** QUESTIONS (each question is worth 10 marks):

1. Gentry Lee, Chief Engineer at the Jet Propulsion Lab, refers to 10 characteristics of Engineers who have a high capacity to become Systems Engineers. List 5 of these characteristics and explain why they are necessary.

2. What is "model-based" systems engineering and what are some of its characteristics?

3. Explain what Value Engineering is and why it is important within the Systems Engineering Lifecycle.

TOTAL: 20 Marks

QUESTION 2

ANSWER **2 OUT OF 3** QUESTIONS (each question is worth 10 marks):

1. Explain how the "business-as-usual" environment differs from the project environment in an organization.

2. As technological uncertainty increases, the type of project implemented changes. Explain this statement.

3. Define risk in projects and how it should be managed.

TOTAL: 20 Marks

QUESTION 3

3.1 Given the following Time Chart for a project:

Activity	a	m	b	Predecessor
A	2	3	4	-
B	1	2	3	A
C	4	5	12	A
D	1	3	5	C,B
E	1	2	3	D

a. Draw the Network Diagram. (7½)
b. Find the critical path using the forward-backward pass method. (5)
c. What is the variance in completion time for the critical path? (1½)

QUESTION 3 CONTINUES OVERLEAF/….
PTO/Page 2…

3.2 A project has an expected completion time of 40 weeks and a standard deviation of 5 weeks. It is assumed that the project completion time is normally distributed.

a. What is the probability of finishing the project in 50 weeks or less? (2)
b. What is the probability of finishing the project in 38 weeks or less? (2)
c. The due date for the project is set so that there is a 90% chance that the project will be finished by this date. What is the date? (2)

3.3 Development of a new deluxe version of a particular software product is being considered. The activities necessary for the completion of this project are listed in the table below along with their costs and completion times in weeks.

Activity	Normal Time	Crash Time	Normal Cost	Crash Cost	Immediate Predecessor
A	4	3	2,000	2,600	-
B	2	1	2,200	2,800	A
C	3	3	500	500	A
D	8	4	2,300	2,600	A
E	6	3	900	1,200	B, D
F	3	2	3,000	4,200	C, E
G	4	2	1,400	2,000	F

a. What is the project expected completion date? (2)
b. What is the total cost required for completing this project on normal time? (1)
c. If you wish to reduce the time required to complete this project by 1 week, which activity should be crashed, and how much will this increase the total cost? (2)

TOTAL: 25 Marks

QUESTION 4

Questions 1 to 6 below refer to the **DWP case attached.**

1. Identify the components of the benefits processing system. (3)
2. What is the purpose of the benefits processing system? (2)
3. For each of the three performance specifications described in the case, describe how they may sub-optimise system performance. (6)
4. What is failure demand? Give an example. (2)
5. Describe a mechanism by which failure demand may impact system performance. (2)
6. Suggest how the system may be designed and managed differently to improve performance. (5)

TOTAL: 20 Marks

QUESTION 5 CONTINUES OVERLEAF/….
PTO/Page 3…

QUESTION 5

5.1 Plot the following SBUs **on the Boston Portfolio Matrix attached**:

a. SBU A has a rapidly declining share of a fast-growing market and accounts for 10% of the company's turnover.
b. SBU B has a slightly growing share of a slowly-growing market and accounts for 20% of the company's turnover.
c. SBU C has a slightly declining share of a slowly but increasing market and accounts for 5% of the company's turnover.
d. SBU D has a declining share of a declining market and accounts for 25% of the company's turnover.
e. SBU E has an increasing share of a slightly declining market and accounts for 30% of the company's turnover.
f. SBU F has a fast-growing share of a growing market and accounts for the 10% of the company's turnover.

You are required to place the SBUs on the Boston Matrix paying careful attention to the position defined for each of them. You should indicate their relative importance of that SBU to the company's turnover by sizing the circle which you use to indicate their position.

5.2 Define what you would do with each of the SBUs **on the attached sheet.**

When you are defining what you would do with each of the SBUs you should think of both the macro strategy you would follow and also of micro strategies to make the macro strategy happen.

TOTAL: 15 Marks

----------END OF EXAM----------

EQUATIONS

$$Z = \frac{X-\mu}{\sigma}$$

$t = (a + 4m + b)/6$

$v = [(b - a)/6]^2$

CASE STUDY

The UK Department of Work and Pensions (DWP) manages the processing and payment of benefits to eligible individuals. To receive their payouts, claimants must go through an application process, described below in an extract from the article "Freedom from Command and Control", by John Seddon 1:

If we think of benefits processing as a system, at a high level, it has three parts: a front office, where claimants are dealt with; a back office, where the benefits are calculated and paid; and these two are usually connected by electronic means – a document image processor; documents are scanned and held on a central database. As is the case with all [system] specifications, those who write them think of things they can measure which seem consistent with doing things properly. While there are a massive number of standards and targets in the DWP specification – all of which need establishing and monitoring, creating a bureaucracy – here are the essential few that sub-optimise the system:

- *Front office: time to see claimants and time to respond to correspondence;*
- *Back office: the percentage of claims paid in a certain time.*

I have little doubt you will be thinking 'why?, for these seem like quite reasonable things to focus on. Yet, as with every example of public services I have studied, these kinds of measures actually create disorder. When local authority personnel study benefits processing as a system, they learn that there is a high level of failure demand in the front office, people 'progress-chasing' and, more importantly, waste ('dirty input') – people not coming in with everything that is required to determine their claim. People in the front office send what they have for scanning, to meet service requirements, and ask the applicant to return with whatever else is required.

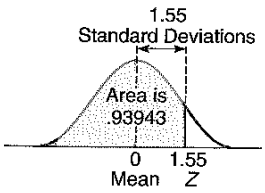
Document image processors – 'scanners' – require that work is sorted and batched into like work types: driving licences must be scanned as a batch, bank statements must be scanned as a batch, and so on. This means that applicants' information is separated and thus needs to be re-connected electronically. Inevitably, documents are poorly scanned, duplicated, lost or wrongly sorted; applicants are frequently asked to bring in things they have already provided. In the back office, the clock for the performance measure begins when all of the required information is to hand. Achieving this is hampered by the way work is designed and managed.

To open up these problems, you need to start by looking at the end-to-end time for processing benefits from the applicants' point of view, establishing a measure of capability. […] The capability measure shows that it could take anything [from 1] up to 134 days to process a benefit from the applicant's point of view.

1 'Freedom from Command and Control: a better way to make the work work', Vanguard Education, 2003. www.lean-service.com

TABLES

APPENDIX I NORMAL CURVE AREAS



To find the area under the normal curve, you can apply either Table I.1 or Table I.2. In Table I.1, you must know how many standard deviations that point is to the right of the mean. Then, the area under the normal curve can be read directly from the normal table. For example, the total area under the normal curve for a point that is 1.55 standard deviations to the right of the mean is .93943.

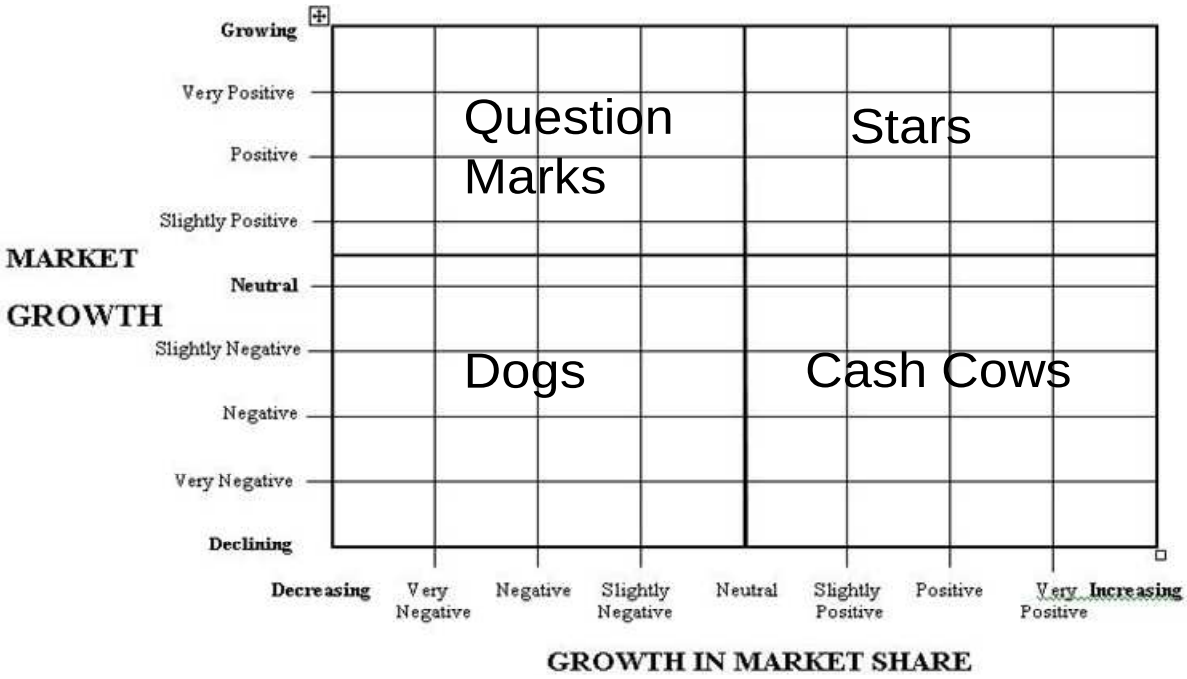
TABLE I.1

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97784	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99899	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

HAND-IN WITH YOUR ANSWER BOOK

STUDENT NUMBER: _____

Boston Consulting Group Matrix



HAND-IN WITH YOUR ANSWER BOOK

STUDENT NUMBER: _____

5.2 Define what you would do with each of the SBUs

a. SBU A

_____
_____
_____
_____

b. SBU B

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c. SBU C

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d. SBU D

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e. SBU E

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f. SBU F

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