Sample examination questions

Questions only

Q.1  Describe the difference between programme management and portfolio management

Q.2  Explain what is meant by a project environment

Q.3  Explain the role of the sponsor in a project organisation and his/her relationship with the project manager

Q.4  a) Explain the purpose of a business case
     b) What costing information is usually part of the business case
     c) Who writes and owns the business case

Q.5  Explain what is meant by stakeholder management and describe how the project manager ensures stakeholder co-operation.

Q.6  Describe the main project organisation structures and give their advantages and disadvantages

Q.7  a) Draw a diagram of a typical project life cycle showing the phases
     b) State 8 advantages for developing a life cycle
     c) What is meant by an extended life cycle

Q.8  a) Draw a simple work breakdown structure for the manufacture of a bicycle
     b) Explain the benefits of using a work breakdown structure
     c) State three other breakdown structures which can be developed from a WBS

Q.9  Explain four types of estimates and give their approximate accuracy rating

Q.10 a) Describe a risk management plan
       b) Explain the risk management process

Q.11 Explain what is meant by a Project Management Plan and give examples of its content.

Q.12 Explain what is meant by the following quality terms:
     a) Quality assurance
     b) Quality systems
     c) Quality control
     d) Quality plan
     e) TQM

Q.13 Explain the stages and documentation required for an effective change management system
Q.14 Explain the purpose and procedures for operating a configuration management system.

Q.15 a) Explain what is meant by a procurement strategy
    b) State and describe 3 types of bonds used in procurement

Q.16 a) State what are the 8 most common causes of accidents in the workplace.
    b) State what is meant by a Health and Safety Plan.

Q.17 Explain what a project manager must do to ensure information is correctly managed.

Q.18 Describe 5 barriers to communication and how they can be overcome.

Q.19 Explain what actions a project manager might take to motivate his/her team.

Q.20 a) Explain the advantages of working as a team
    b) State the four development stages of a project team?

Q.21 List and describe the nine types of team members as defined by Belbin.

Q.22 Describe the qualities of a leader, especially in a project environment.

Q.23 Describe the five Kilman approaches to resolving conflicts.

Q.24 a) Explain what steps a project manager must take to ensure a smooth project close out and handover
    b) Describe a project close out report.

Q.25 The activities of a project have the following durations (in weeks), dependencies and resources (operatives).

Q.26 Using the information from question 25,
    1) Draw the bar chart from the network
    2) Draw the histogram for the resources
    3) Draw the cumulative resource “S” curve.

Q.27 A project consisting of 6 activities (A to F), the budgets, the % complete and the actual recorded costs for a specific point in time are as shown below.

Q.28 A project has an original budget of £600,000 and after the first 4 months of a 12 months planned project time, the Scheduled Costs, Actual Costs and Earned Values are as follows:

Q.29 With an original investment of £45,000 and the net returns given below, two projects, A and B are competing for the funds.

Q.30 With an original investment of £50,000
    What is the IRR?
    (Obtain the discount factors from the table in the book: Project Management, Planning and Control, page 22)

**Tips and techniques for the APMP examination**

1) Candidates have to answer 10 out of 16 set questions in 3 hours. As all question carry the same number of marks, allow just under 18 minutes per question.

2) Allow 5 minutes to read through all the questions before starting the actual answering.
3) Read each question twice before answering. **Read twice – Write once**

4) Start answering the questions considered easiest first.

5) Questions can be answered in any sequence

6) Start a new page for every question

7) Where an answer requires more than one page, number the pages as follows:
   - Question 1 page 1, Question 1 page 2 etc.
   - Question 4 page 1, Question 4 page 2 etc.
   This enables another page to be added later (if there is time at the end) to amplify the answer

8) Always draw a diagram to explain a point where this is possible in addition to the required narrative answer

9) Where the answer requires more than one curve in a diagram, use different coloured pens or biros for each curve. (Note, pencils are not permitted)

10) The question require several levels of details for the answers. These are characterised by the verbs: **List, State, Describe, Explain**. The requirements of each are as follows:

   - **List**
     A simple list of terms or phrases forming a structured sentence. More detailed descriptions or explanations are not required

   - **State**
     A single coherent sentence summarising the meaning of each point made

   - **Describe**
     A short paragraph of more than one sentence describing clearly what is meant or understood by each point or phrase

   - **Explain**
     A clear explanation of the meaning of a technique, idea or concept etc. Where more than one point is involved, each point requires a paragraph of two or more sentences highlighted by simple diagrams if appropriate

11) In a network diagram, always add the arrow heads to the links or activity lines and always start with 0 as the first week (or day) number

12) In a WBS or PBS, always add the stage numbers to the boxes. i.e. 0, 1.0, 2.0, 3.0, 1.1, 1.1.1, 1.2, 1.2.1, etc. Always mark the first box (at the top of the the diagram) 0

**Questions & Answers**

**Q.1** Describe the difference between programme management and portfolio management

**A.1**

Programme management is co-ordination of a group of related projects to ensure that the strategic objectives of the organisation are met in the most cost effective and efficient manner. This requires the allocation of resources (physical and financial) to all the projects which make up the programme.

In most cases the programme manager will be responsible to a senior executive in the organisation and be responsible for project managers and the performance, success and profitability of their projects.
The focus of the programme manager is on the business benefits and the timely delivery of the main phases of the programme and its component projects.

A portfolio manager is more concerned with the performance of each of the individual projects which are not necessarily related and which do not necessarily have to conform to the company’s strategic objectives to the same extent.

The projects in a portfolio could be very diverse, be for different clients and may have to be delivered or constructed in different countries to different standards.

However in both cases the responsibilities of the programme manager and portfolio manager are very similar in that both are concerned to meet the same criteria such as:

Profitability
Cost benefit
Cash flow
Risk reduction
Company prestige
Environmental acceptance
Long term objectives.

The order given is not necessarily the order of priority.

Reference: PMP&C, Chapter 3, & bullet point answers, No. 1.2 and 1.3

Q.2 Explain what is meant by a project environment

A.2

The project environment or context is the name given to all the influences and restraints which affect any or all the stages of the project.

The external environment contains the PESTLE factors which all have to be taken into consideration when making project decisions.

The internal environment, which is more under the control of the project manager includes the client, sponsor, contractors, suppliers, support staff of the company, consultants, utilities end users and even the general public.

Although the project manager may have little or no control over the external influences, he/she must carry out a risk assessment and prepare appropriate contingency plans to counter or mitigate any hazards or disruptive behaviour which may adversely affect the objectives of the project.

Among the external influences may be counted environmental pressure groups who may wish the whole project stopped, or political organisations who may cause serious delays due to beaurocratic procedures.

Internal influences could also endanger the project if the project manager is unable to obtain the co-operation of the departmental managers or the full support of top management.

Last but not least are the financial restraints which could affect the project due to poor cash flow, suppliers, contractors or subcontractors becoming insolvent or overdraft limits of the client (or parent organisation) being exceeded. Such hazards could seriously affect progress and increase the final cost of the project.

Reference: PMP&C, Chapter 4, & bullet point answers, No. 1.4
Q.3 Explain the role of the sponsor in a project organisation and his/her relationship with the project manager

A.3

Before a project can be considered for receiving funding, a business case has to be prepared. The preparation and submission of the document is the responsibility of the sponsor, who has to convince the funding authority that the project will be viable, profitable and fit the organisation’s business strategy.

Having produced the business case, his/her main roles are to act as champion for the project, and convince the Board of the project’s virtues and cost benefits, assist in the appointment of the project manager and monitor his/her performance for the duration of the project.

In addition he/she has to approve all variations whether generated internally or externally, and help in resolving problems with stakeholders. This applies both to positive and negative stakeholders. With positive stakeholders, the sponsor may use his/her influence to obtain more resources (usually money) while with negative stakeholders he/she can act as a negotiator and help to resolve problems and allay fears.

The sponsor will also support the project manager and team by ensuring the timely supply of sufficient resources, act as mentor to the project manager and represent the “Project” in high level negotiations with other Board members.

It can be seen therefore that there is a close relationship between the sponsor and the project manager who may in some cases assist in the preparation of the business case even before he/she has been officially appointed.

Reference: PMP&C, Chapter 5, & bullet point answers, No. 5.1

Q.4 a) Explain the purpose of a business case
     b) What costing information is usually part of the business case
     c) Who writes and owns the business case

A.4

a) The business case sets out the What and the Why of a project. What do we want or need and why do we need it? It sets out the major criteria and deliverables, the key performance indicators, the required quality standards and the major perceived risks. Its main purpose is to explain the fundamentals such as the business benefits, environmental benefits and the cost/benefit assessment to the Board or other senior management body and persuade them to provide the necessary funds and resources to carry out the project.

Also included in the business case is the list of important stakeholders and their potential influence (positive or negative) on the project.

b) The business case should include an assessment of the capital, operating and in some cases the decommissioning costs which have to be expended over the life of the project. Also included will be a cash flow analysis using NPV (DCF) and IRR techniques to prove the viability of the project.
c) The business case is usually written by the sponsor, although he/she may be assisted by the prospective project manager and other staff including the end user. It becomes the brief for the project management plan which is owned by the project manager. However the ownership and the overall responsibility of the business case rests with the sponsor.

Reference: PMP&C, Chapter 5, & bullet point answers, No. 5.1

Q.5  Explain what is meant by stakeholder management and describe how the project manager ensures stakeholder co-operation

A.5

Stakeholder management is the identification and classification of stakeholders for the purpose of maximising their useful contribution or minimising their disruptive influences.

Stakeholders can be direct or indirect and positive or negative.

Among the direct stakeholders are the project manager, project sponsor, the project team, clients, consultants, service providers, suppliers and contractors.

Indirect stakeholders include the organisation’s support staff, local governments, utility companies and the families of the project team.

Positive stakeholders support aims and objectives of the project and usually have an interest in its success. As such they can be direct or indirect.

Negative stakeholders on the other hand generally want the project to modified in some way or stopped altogether for environmental, cost or political reasons, perceived employment loss or a host of other motives.

The project manager must be aware of these objections and must try to placate or mitigate their actions which could seriously jeopardise the project.

On the other hand the positive stakeholders must be fostered and their contribution facilitated and maximised for the benefit of the project.

The following table can be produced as a summary of the influences of the different stakeholders

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Interest</th>
<th>Influence impact</th>
<th>Probability</th>
<th>Action to maximize support</th>
<th>Reaction to minimize disruption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Reference: PMP&C, Chapter 7, & bullet point answers, No. 2.2
**Q.6** Describe the main project organisation structures and give their advantages and disadvantages

**A.6**

There are three main project organisation structures:

1) Functional
2) Project (Task force)
3) Matrix

1) Functional

This is suitable for small departmental (or interdepartmental) projects where the department head or delegate takes on the role of a temporary project manager for the duration of the project. However such a project manager has no authority over departments other than his/her own. If other departments are involved, a project co-ordinator is required to ensure a working reasonable relationship is maintained.

2) Project (Task Force)

This type of project organisation is usually only used on large projects as it may require its own offices or even buildings as well as all the necessary support departments such as accounts, construction and HR.

The project manager has complete control over costs and progress and is responsible for quality and the performance and well being of the team.

While there is high motivation during the life of the project, this can turn to a feeling of insecurity as the project approaches completion and no other assignment is in sight.

3) Matrix

The matrix type of project organisation is a combination of the above two. Staff are seconded or assigned to the project from the various departments and as they do not actually physically leave their own department, only book to the project when needed. They are responsible to the project manager for progress and to the departmental manager for quality and costs. They therefore have in effect two bosses which can be the cause of conflict.

The pros and cons of the three types of organisation are therefore as follows:

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td>Continual specialisation, Minimises duplication, Simple reporting relationship, Ordered line management</td>
<td>Burden on management to co-ordinate, Can develop parochialism, Limited scope for personal development, Limited control by project manager</td>
</tr>
<tr>
<td>Project</td>
<td>High effectiveness, Good communication, Tight control of costs, High staff motivation, Good control of progress</td>
<td>Loss of specialised knowledge by staff, Can develop project parochialism, Too orientated to tools and techniques, Expensive to set up and maintain</td>
</tr>
</tbody>
</table>
The diagram below shows the essential relationship between the project manager and the functional departments for the three project organisation structures.

Reference: PMP&C, Chapter 9, & bullet point answers, No. 6.7

**Q.7**

a) Draw a diagram of a typical project life cycle showing the phases
b) State 8 advantages for developing a life cycle

c) What is meant by an extended life cycle

**A.7**

<table>
<thead>
<tr>
<th>Concept</th>
<th>Feasibility</th>
<th>Definition</th>
<th>Design Develop</th>
<th>Production</th>
<th>In-service</th>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Life Cycle</td>
<td></td>
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<tr>
<td>Product Life Cycle</td>
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<tr>
<td>Extended Life Cycle</td>
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</tbody>
</table>

a) Project Life cycle diagram

b) Advantages:

1) Breaks project into major phases, which in turn can be broken down into stages. This facilitates better control of subsequent work packages

2) Sets up “Go/No-Go gates between phases which are decision points whether to continue to the next phase or abort

3) Phases can be costed and timed (approximately) to give a rough cash requirement profile
4) When bars are drawn to a time scale, the chart becomes a high level progress reporting chart for use by top management.

5) The phases can be used to define the different management roles over the life of the project.

6) Gives an opportunity to carry out rolling wave planning, where more attention is given to the current phase and broader planning to the following phases.

7) Acts as a communication document to the whole team as it shows how the project develops.

8) Resources (including money) can be allocated for each phase well in advance of actual requirements.

c) An extended life cycle includes the decommissioning and disposal phases, which in large projects can be projects in their own right. Examples are nuclear power stations and off shore oil platforms.

Reference: PMP&C, Chapter 11, & bullet point answers, No. 6.1

**Q.8**

a) *Draw a simple work breakdown structure for the manufacture of a bicycle*

b) *Explain the benefits of using a work breakdown structure*

c) *State three other breakdown structures which can be developed from a WBS*

**A.8**

![WBS of a bicycle](image)

a) WBS of a bicycle

b) The benefits of a WBS are:

1) The project is broken down into manageable stages for further decomposition into smaller chunks until an activity level is reached suitable for using in a planning network.

2) The decomposition can be carried out until each chunk can be accurately costed, producing a cost breakdown structure which facilitate estimating.

3) Each level of a WBS is of approximately the same management status, which helps in assigning responsibilities.

4) A WBS is an excellent prompt list for risk identification.

5) A WBS is in effect a hierarchical family tree of the project and becomes a simple but clear communication document showing the way the project is constructed.
c) The other three breakdown structure are:

1) Product Breakdown Structure (PBS). This shows the components required for the project and is characterised by the use of nouns rather than verbs as used in the WBS.

2) Cost Breakdown Structure (CBS). Here the stages of the WBS or PBS have been given a cost value, so that the aggregate of all the stages becomes the total cost of the project. This cost allocation can be used as an estimating method for “bottom up” or “top down” estimates.

3) Organisation Breakdown Structure (OBS). Here the names of the departments or the departmental managers are added to the stages, so that one can easily see who is responsible for a particular stage. The name at the top stage is that of the project manager.

Reference: PMP&C, Chapter 12, & bullet point answers, No. 3.1

Q.9

Explain four types of estimates and give their approximate accuracy rating

A.9

The four main types of estimates are:

1) Subjective
2) Parametric
3) Comparative
4) Analytical

1) Subjective

When asked to give an estimate at the proposal stage before a proper specification is available, a contractor may be prepared to give a “ball park” figure. This is a subjective assessment of costs based on past experience and “hunch”. It clearly depends on the amount of factual information available but by its very nature has an accuracy of between $\pm 20$ to $40\%$.

2) Parametric

At the budget preparation stage, a parametric estimate may well be the cheapest method. By using well-known empirical formulae in which costs are related to physical characteristics, a good estimate with an accuracy of 10 to 20% can be obtained. For example, an architect is able to give an approximate cost of a house by multiplying the cube (length $\times$ breadth $\times$ height) of the finished structure by a cost/cubic metre value which varies with the desired quality of construction. Similarly, an office block can be costed per square metre of lettable floor area, or a road by the milage which includes even bridges and cuttings.

3) Comparative

When a new project or work package can be compared with a similar (preferably recent) one, having the same basic features, a comparative estimate will give a fair cost of the new work. Due allowance must be made for location, inflation and any significant differences, but an accuracy of $\pm 10\%$ should be possible.

4) Analytical

Once all the specification and main layout drawings have been prepared, an analytical estimate can be prepared. Here every component and work package consisting of labour and materials, must be individually costed and the results summed. Labour can be estimated using work
norms and materials costs can be obtained from suppliers. The accuracy of such an estimate should be $+/-5\%$

In all cases a contingency allowance should be added to the estimate.

Reference: PMP&C, Chapter 14, & bullet point answers, No. 4.3

**Q.10** a) Describe a risk management plan

b) Explain the risk management process

**A.10**

a) A risk management plan is a high level document which sets out the main parameters of how the risks are to be managed. It includes the description of the project, the types of risks to be considered, the risk process, including the tools and techniques to be followed, the risk reporting procedure and the major risks envisaged.

b) The risk management process consists of 5 major stages:

1) Risk awareness

   This is an appreciation that risks do exist and must be faced. It is an attitude of mind to consider risks seriously, without which risk analysis is not possible

2) Risk identification

   This involves compiling a list of possible risks which could occur over the life of the project. The risks can cover the whole spectrum of PESTLE (Political, economic, sociological, technical, legal, environmental). To identify these risks the following methods are available: Brainstorming, check or prompt lists, delphi technique, interviews and assessing the risks of the various WBS stages. After due examination the risks will have to be prioritised.

3) Risk assessment

   Here each risk is assessed in terms of probability and severity (or impact). A conventional method is to produce a P/I matrix by giving each risk a qualitative low, medium or high rating.

   ![Typical 3 x 3 P (probability)/I (impact) matrix](image)

4) Risk evaluation

   After the qualitative assessment, a quantitative evaluation can be made by giving values to the degree of probability and impact of each risk. The mathematical product of these two is the risk exposure. This gives a priority list for risks to require special attention.
For example, if the values can vary from 1 to 10 for both probability and impact, a risk exposure rating of 72 (exposure 9 and impact 8) can be considered to be serious and may require a more rigorous analysis including a Moneta Car simulation.

5) Risk management

Once the risk has been assessed and evaluated it must be managed. The available options to the project manager or risk owner are:

- Avoidance (engineering out)
- Reduction
- Deference
- Transference (insurance)
- Mitigation
- or
- Acceptance with provision for contingencies

The risk management process includes a risk register (risk log) which lists and records on an ongoing basis the following:

- Risk type
- Description of the risk
- Probability
- Impact
- Mitigation strategy
- Contingencies (usually money)
- Name of risk owner.

The risk register must be kept up to date with past risks being crossed out and new ones added on a regular basis.

Reference: PMP&C, Chapter 16, & bullet point answers, No. 2.5

Q.11 Explain what is meant by a Project Management Plan and give examples of its content.

A.11

A project management plan (PMP), sometimes also called a project co-ordination procedure or project initiation document (PID), is in effect the bible of the project. It is produced and owned by the project manager and reflects his/her interpretation of the business case or brief.

It encapsulates the What, Why, When, How, Where and Who as well as the How much of the project, and acts as a reference document for the whole project management team throughout the period of the project.

The contents of the PMP include:

- Project description and scope
- Aims and objectives and key performance indicators
- Monitoring and reporting procedures
- Project programme (schedule), either in network form or as a bar chart
- Milestones and key dates
- Project organisation chart (OBS) and project staff directory
- Terms of reference of key team members
Major stakeholders
WBS or PBS
Location details and delivery requirements
Procurement strategy and purchasing restraints
Acceptance procedures and criteria
Communication plan
Quality plan
Risk management plan
Health and safety plan
Cost plan
Design standards
Planning tools and techniques (including software)
Document distribution schedule
Close out procedure

A more complete list of suggested contents is published in BS 6079, “Guide to Project Management”

The PMP is a live document and must be constantly updated and reissued in accordance with set configuration management procedures.

Where the cost information is confidential, it can be omitted from the PMP and published separately for restricted circulation.

Reference: PMP&C, Chapter 15, & bullet point answers, No. 2.4

Q.12  Explain what is meant by the following quality terms:

a) Quality assurance
b) Quality systems
c) Quality control
d) Quality plan
e) TQM

A.12

a) Quality assurance

These are the procedures that ensure that all the quality systems and processes have been set up, incorporated and implemented. This is evidenced by a number of documents to prove that adequate controls are in place and are being operated in accordance with set procedures. The quality assurance documentation is often required to be submitted by a tenderer to convince the purchaser that satisfactory quality procedures are being followed.

b) Quality systems

These are the standard procedures for carrying out quality control and cover the whole life of a product i.e. design, procurement, manufacture and operation. The quality systems also cover the documentation to ensure compliance with the set quality standards as well as permissible deviation criteria.
c) Quality control

These are the actions to be taken to control the quality of a product or service. It covers the tools and documents necessary to carry out the tests and checks during the design, specification writing, manufacturing assembly and distribution stages.

d) Quality plan

The composition of this document can vary greatly from company to company. It can be a general set of instruction or a detailed set of actual tests and checks for every component. The document is project specific and defines all the processes required. It includes a list of standards and documents, any required proficiency tests, material test ((destructive and non-destructive) the methods of inspection (e.g. radiography, ultrasound etc.) and the degree of inspection for every component. It also gives the frequency of reviews required by the inspection authority.

e) TQM

Total quality management (TQM), covers the approach to quality of the whole organisation. The key principles of TQM are:

- Understanding and meeting the needs of the customer
- Ensuring everyone is responsible for the quality of their own output or portion of the work
- Ensuring every part of the organisation is involved and covered by the quality procedures
- Getting things right first time, thus eliminating rework
- Setting company wide quality procedures and processes at top management level
- Appreciating that cost of prevention is less that cost of rectification
- Accepting that continuous improvement is ongoing and is built on collective experience

Reference: PMP&C, Chapter 17, & bullet point answers, No. 2.6

Q.13   **Explain the stages and documentation required for an effective change management system**

A.13

There are very few projects which do not need changes to be incorporated during the design and implementation phases. These changes must be assessed approved and recorded to ensure that costs and schedules (programmes) do not spiral out of control.

The start of a change procedure is the issue of a *change request* by the client or any other member of the project team. This change request form sets out the details of the requested change and the reason for its requirement.

The change request is received by the project manager who issues a *change advice notice* to all departments associated with the project. Each department now adds their assessment of the cost, time and performance implications of the proposed change as it affects their particular portion of the work.

After a predetermined time, this change advice notice is returned to the project manager who uses the received information to assess the total cost and the additional time requirement. He/she also notes any performance implications.

This information is now returned to the originator and sponsor for written approval, after which the project manager issues a *change order* to start work to incorporate the change.
To keep track of the changes a change record (or change log) is kept by the project manager which records the following:

Description of the change  
Reason for the change  
Originator of the change  
Date of request for the change  
Date of submission for approval  
Date of approval  
Effect on cost  
Effect on schedule  
Effect on performance  
Date of change order to start work

It must be noted that any change by the client will increase or decrease the contract value as well affecting the project duration, but a internal change due to an error or omission cannot be back charged to the client. All changes have to be processed in exactly the same manner, but while an internal change will undoubtedly increase (or decrease) the cost, it will not affect the contract value.

Reference: PMP&C, Chapter 18, & bullet point answers, No. 3.5

Q.14 Explain the purpose and procedures for operating a configuration management system

A.14

Configuration management is an essential part of project management, as without it the numerous (sometimes hundreds) of variations cannot be controlled.

This does not only apply to data, drawings and documents in general, but also to hardware and computer software, where it is vital that all parties are supplied with, and are able to use, the latest version.

There are 5 stages for operating a configuration management system:

1) Configuration management and planning

This covers the procedures to be adopted, the standards to be used and the resources and facilities required. It also covers training and review and audit intervals.

2) Identification

Here the systems and procedures are established and the scope and type of items to be covered by configuration management set out

3) Configuration change management

This stage covers the actual changes and the methods of investigation before a change is accepted

4) Configuration status accounting

This relates to the records and registers to be kept for ensuring the timely and correct distribution of documents relating to the changes.
5) Configuration audit

The audit is required at certain stages to check that the system has been correctly applied and the changes incorporated by the project organisation.

To control the changes, a master record index has to be drawn up which records the change of every document, when the change was made, who initiated the change, who approved it, when it was distributed and who received it.

Reference: PMP&C, Chapter 19, & bullet point answers, No. 4.7

Q.15  a) Explain what is meant by a procurement strategy
     b) State and describe 3 types of bonds used in procurement

A.15

a) A procurement strategy sets out the main criteria for procurement of goods and services for the whole project from the invitation to tender stage to the delivery and shipping stage.

The areas covered by this strategy document are:

1) The scope of the procurement operation and why it is needed
2) What will be made in-house, what can be leased and what has to be bought out
3) Which sections have a construction element, thus requiring subcontract documentation
4) What will be the size of the original tender (bid) list
5) What will be the size of the short list
6) Will there be pre-tender surveys and pre-tender interviews
7) Are some of the purchases subject to EC regulations
8) Will procurement be world-wide or restricted to certain countries
9) Which (if any) companies must be on the tender list and which must be excluded
10) What will be the country of jurisdiction in case of disputes
11) Who will be represented on the bid opening panel
12) Are there any shipping restrictions
13) What are the major risks with certain important sections
14) Which materials will be ordered from site
15) Will retention bonds be accepted on principle
16) What other bonds are permitted to be accepted

b) The following bonds are used in procurement:

1) Advance payment bond
   This is a bond given by the supplier to protect the purchaser in case the supplier or contractor defaults on his supply of the ordered goods, when payments have been made before receipt of the goods
2) Performance bond
This bond protects the purchaser in case the supplier or contractor withdraws during the contract or does not meet his contractual obligations. The purchaser then calls in the bond and possibly appoints another contractor.

3) Retention bond
This bond is given in return for the release of retention monies at the completion of work and the issue of a certificate of substantial completion.

When the maintenance (or guarantee) period is over, (usually after 12 months) and all the outstanding work has been satisfactorily carried out, the bond is returned to the contractor

Reference: PMP&C, Chapter 34, & bullet point answers, No. 5.4

Q.16  
  a) State what are the 8 most common causes of accidents in the work place.
  b) State what is meant by a Health and Safety Plan.

A.16

a) The most common causes of accidents in the workplace are:

1) Equipment or machinery failure, lack of maintenance, badly sited emergency switches
2) Fire, hot surfaces, combustible liquids
3) Electrical failures, short circuits, poor insulation
4) Spillage of hazardous substances, lack of neutralising stations
5) Unhealthy conditions, lack of ventilation, dust, fumes, poor lighting
6) Poor design of equipment, lack of safety devices, insecure guards, poor supervision
7) Unsafe operating practices, faulty lifting and handling equipment, lack of permits to work
8) Excessive noise, vibration, glare or poor visibility

b) The health and safety plan has the following sections:

1) Description of the work or project
2) Project programme and milestones
3) A list of major risks as abstracted from the risk register
4) The list of statutory information to be submitted to the client to show compliance with the H&S regulations including stall welfare facilities.

The health and safety plan can be in two stages. The first stage is submitted with the tender documents and the second part of the plan is prepared once the work has started. Clearly the last part is more detailed and could include method studies of certain important operations involving lifting equipment or other special devices.

Reference: PMP&C, Chapter 36, & bullet point answers, No. 2.7
Q.17  Explain what a project manager must do to ensure information is correctly managed

A.17

Without adequate, accurate and timely information and a good information flow, a project would soon grind to a halt. The project manager must ensure that the information is properly gathered, assessed and quickly distributed for further action. In addition it is important to ensure that the information is factually correct before it is distributed and a reliable system of checks must be in place which must be constantly revised and improved as necessary. This includes a procedure for acknowledging receipt of the information.

One of the most important requirements is to confirm all verbal instructions, contracts or other meaningful discussions in writing. In the words of Sam Goldwyn, “A verbal contract is not worth the paper it is (not) written on”

As part of the PMP, the project manager has to draw up an information plan which sets out:

The type of documents covered by the plan
The authority to produce and sign documents
Methods of distribution and distribution schedule
Methods for storing and archiving information and data
Methods and procedures for retrieval
Periods for acknowledgement

Security arrangements
Disaster recovery plan
Configuration control
Foreseeable risks

The last four in this list will have their own plans and will only be referred to by their document number

Different stakeholders (especially top management) require different levels of information at different intervals and at different times. These requirements can be annotated on the document distribution schedule to ensure consistency over the period of the project.

In addition, it is the project manager’s responsibility to ensure that the various types of communication equipment relevant to the information to be transmitted, are properly and regularly maintained and are updated as soon as new versions or models become available.

Reference: PMP&C, Chapter 37, & bullet point answers, No. 7.1

Q.18  Describe 5 barriers to communication and how they can be overcome.

A.18

The following are the five more common barriers to communication:

1) Unclear objectives

If the project objectives and directions are unclear or ambiguous, misinterpretation will result. The solution is to ensure clarity and simplicity by using plain language, keeping instructions and messages short and checking texts for accuracy before distributing them.
2) Cultural differences
This is usually a problem with international projects where relationships can suffer because the cultural and/or religious customs are not appreciated or observed by one of the parties.

The problem can be overcome by training and lectures on the history and customs of the countries to be visited or worked with. Occasional visits can be very beneficial.

3) Language
Again usually only a problem when dealing with foreign countries. Even if all the parties (as is becoming more common) use English as the common language, pronunciations, meanings and nuances may differ. A word in England may have a different meaning in America (e.g. “lift” or “schedule”)

A course of lectures at which the known differences will be highlighted and explained, will help to reduce the problem. Translations should always be made by a person who is a native speaker of the language into which the document has to be translated.

4) Geographical separation
Project stakeholders are often in different parts of the country. This causes communication problems not only with late mail deliveries and poor telephone lines but also with regional accents. In addition time differences must be taken into account when using the telephone.

The solution is to try to form a project team in one place or arrange regular meetings of staff to get to know and understand each other better.

5) Attitude and selective listening
When two people do not like each other, they may not listen properly to what they say or give due consideration to the other’s point of view or arguments. They may even ignore their correspondence altogether.

When this becomes apparent, the project manager must take action and both parties firmly told that co-operation is paramount.

Reference: PMP&C, Chapter 38, & bullet point answers, No. 7.1

Q.19  Explain what actions a project manager might take to motivate his/her team

A.19

Unless the project team members are motivated, the project is unlikely to meet some of its Key Performance Indicators

The project manager must take the time to get to know each team member and instil a sense of belonging to a worthwhile project which tends to create the will to succeed. To do this he/she must give full reign to an individual’s capability by giving the maximum responsibility consistent with his/her ability and experience.

Individuals must have a full understanding of their role in the project, and be given clear achievable goals which must be celebrated when realised

Achievements of team members must be recognised, appreciated and suitably rewarded.
Timely completion to cost and quality criteria may be rewarded with bonuses or other perks, including the possibility of further advancement or promotion.

The working environment must be pleasant and safe, the atmosphere friendly and the work itself made as interesting and varied as possible.

It is assumed that the basic motivation factors such as physiological needs, security, safety and social relationships as set out in Herzberg’s motivational theory have been met, so that the project manager is able to concentrate on the higher needs such as group dynamics, self esteem and self actualisation.

Staff morale can also be enhanced by organising social activities, away days and education programmes

Reference: PMP&C, Chapter 39, & bullet point answers, No. 7.2

Q.20  
a) Explain the advantages of working as a team  
b) State the four development stages of a project team?

A.20

a) The advantages of working as a team are:
1) The many different skills of the various team members may be focused to meet the project’s performance criteria.
2) The collective experience of the team members can generate meaningful discussion which assists in resolving problems
3) New ideas are more easily generated and speedily discussed, tested and implemented
4) The close relationship between members increases the spirit of co-operation and engenders the motivation to succeed.
5) Team members can support and assist each other
6) The short lines of communication enable misunderstandings to be reduced and enable decisions to be speedily implemented.
7) If properly led by the project manager, project team members will feel proud to be a part of successful organisation and will show this by hard work, loyalty and dedication.

b) Team development has been studied by Tuckman who postulated the following four stages for team development:

1) Forming
2) Storming
3) Norming
4) Performing

1) Forming
This is the stage where the team members first meet each other. Under the leadership of the project manager they will be assigned their roles and duties
2) Storming
Certain team members may feel that they have not been given enough authority or responsibility, while others may feel they will be over stretched. There will be some jockeying for position and this will throw up problems which require all the skills of the project manager to resolve.

3) Norming
By now the team members have settled down and begin to carry out the duties assigned to them. The project manager may still have to make some adjustments to the degree of responsibility given to some members and arrange any necessary support if required.

4) Performing
The team is now operating as a fully integrated group. Each member is able to perform to the best of his/her abilities for the benefit of the project.

5) Mourning
Although not part of the Tuckman analysis, there is a mourning stage when the project comes to an end and the team is disbanded. There will be sadness as well as apprehension of what will follow. Close personal relationships built up over the period of the project will now have to come to an end.

Reference: PMP&C, Chapter 39, & bullet point answers, No. 7.2

Q.21 List and describe the nine types of team members as defined by Belbin

A.21

Belbin described the following characteristics required for a balanced project team:

1) Plant
2) Resource Investigator
3) Co-ordinator
4) Shaper
5) Monitor/evaluator
6) Team worker
7) Implementer
8) Completer finisher
9) Specialist

1) Plant
Plants are creative and imaginative and are good at solving difficult problems. They are needed to bring new ideas to the project but their unorthodox behaviour and inability to take criticism may make them difficult to manage.

2) Resource Investigator
Such a person is generally extrovert, has good communication skills and responds positively to new challenges. However he/she tends to loose interest when the problem has been resolved.
3) Co-ordinator
Co-ordinators are calm, stable and self controlled. Their self confidence enables them to clearly identify the goals and objectives. Because they are good at delegation, they are often perceived to be lazy.

4) Shaper
Shapers are good task leaders. They are dynamic, thrive under pressure and get things done by sheer determination. However they tend to have a quick temper.

5) Monitor/evaluator
These people are sober, prudent and able to evaluate options. They have a good sense of judgement, but can be tackles and over critical.

6) Team worker
Team workers are co-operative, socially orientated and reliable. Though indecisive, their quiet unifying attitude is often not appreciated until they are absent.

7) Implementer
Efficient and systematic, implementers turn ideas into action. Their disciplined approach may be inflexible.

8) Completer finisher
These types make excellent checkers as their painstaking approach to detail ensures that nothing is forgotten and errors are exposed. Although often derided as nit-picking, their perfectionist attitude can prevent costly mistakes getting through the system.

9) Specialist
Specialists have key skills which are often in short supply. They are single minded, self reliant professional experts, but their dedication to their own field of expertise and their unwillingness to see the bigger picture, sometimes makes them difficult to control.

In real life, most people are a mix of a number of Belbin characteristics and while it is often only possible to choose whoever happens to be available with the right technical skills, a knowledge of their personality characteristics helps in their actual task assignment.

Reference: PMP&C, Chapter 39, & bullet point answers, No.7.2

Q.22  Describe the qualities of a leader, especially in a project environment

A.22

Although it may be argued that leaders are born rather than made, leadership qualities are probably the result of environmental factors, upbringing and training.

The qualities required are primarily the ability to persuade and inspire others to follow a defined course of action or behaviour.

This requires the leader to have a certain amount of charisma, be a good communicator, be fully committed to the project, be able to motivate and encourage the team or followers.

He/she should be honest, fair, flexible, prudent, open minded and be a good listener.
He/she should be able to inspire the team by setting clear aims and objectives, foster a climate of co-operation and encourage new ideas and initiatives.

A good leader must be able to delegate assignments and monitor them without being too intrusive.

Above all, he/she must gain and keep the confidence of the team and ensure that even if the decisions are not to everyone’s liking, his/her respect is not diminished.

In cases of internal disputes or disagreements, a good leader must be able to spot the problem early and “nip it in the bud” before it can develop into a full blown confrontation. This requires a sense of fairness and an ability to cut through the peripheral arguments to get to the root of the problem.

A good leader must be able to change his management style to suit the situation he/she is in at the time. This will depend on the level of maturity, i.e. the education, ability, experience and self confidence, of the various individuals in the project group.

Reference: PMP&C, Chapter 40, & bullet point answers, No. 7.3

**Q.23  Describe the five Kilman approaches to resolving conflicts**

**A.23**

Thomas & Kilman have studied the management of conflict and identified the following possible approaches:

1) Forcing
2) Confronting
3) Compromise
4) Smoothing
5) Withdrawing

1) Forcing
This involves one party using its power or authority to force an issue through by virtue of financial muscle, technical expertise or rank. This is common in the armed forces, but can also be used in business when safety is at risk or when important principles have to be maintained. Often the other party leaves the table aggrieved ad future relations may become strained if not terminated.

2) Confronting
Here both parties confront the issues squarely by examining what the disagreement is all about and examining their common ground. If the parties realise that no agreement can be disastrous for both, and have the will to succeed, this approach can retain good relations for future co-operation.

3) Compromising
This is a very common method to resolve a conflict, but both sides loose something. It does however enable work to proceed if not in the happiest of atmosphere.
4) Smoothing

This is the case where one party is prepared to surrender part of their claim in order to maintain good relations. It generally occurs where the arguments of one side are more valid and unassailable and where further disagreement can increase costs in terms of cash and management time.

5) Withdrawing

This tactic can be used where no solutions appears to be possible. By withdrawing at this stage it may be possible to return at a later date when tempers have cooled and the dust settled. Indeed the problems may even have reduced in importance. If the conflict is intractable, the answer may be adjudication, arbitration or litigation.

Reference: PMP&C, Chapter 42, & bullet point answers, No. 7.4

Q.24  
   a) Explain what steps a project manager must take to ensure a smooth project close out and handover
   b) Describe a project close out report

A.24

a) When a project has been completed and all the systems tested and checked, it must be formally closed out and formally handed over to the client, operator or end user.

The project close out requires the issuing of a close out order which instructs all staff working on the project that no more time may be booked to the project and no more materials or services purchased without the express permission of the project manager. Failure to do this will result in project “creep” with manhours as it were slipping through the fingers.

Clearly there are situations where extra work has to be carried out after this stage, but these costs should be minimal and would normally be covered by a contingency sum set up for this purpose.

Contractors’ and suppliers’ claims will have to be settled or negotiated so that the close out report will reflect the true financial position.

The handover to the client or operator etc. consists of the issue of a handover certificate which confirms that the work is complete and also lists any outstanding (usually minor) work still to be carried out.

Apart from retention sums, this handover certificate is a trigger for submitting the final payment invoice. At the same time as handing over the completed facility for operation, the project manager also hands over all the necessary documentation including operating and maintenance instructions, test certificates, QA records, suppliers’ guarantees and warranties, equipment performance certificates and priced spares lists.

When the site has been cleared and all surplus materials disposed of, a joint party to celebrate the completion is often a good way to soothe the “mourning” phase.

b) A close out report and review will list all the major problems encountered and how they were overcome. Comparisons will be shown between the original and actual cost, time and performance criteria. Also given will be a review of the performance of project staff, suppliers, contractors and other major stakeholders.
The close out report will then be archived for consultation by future project managers who may be involved with similar projects.

Reference: PMP&C, Chapters 43 and 44, & bullet point answers, No. 6.5

**Q.25** The activities of a project have the following durations (in weeks), dependencies and resources (operatives)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration (weeks)</th>
<th>Dependency</th>
<th>Resource (operatives/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>A</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>7</td>
<td>B &amp; D</td>
<td>8</td>
</tr>
<tr>
<td>F</td>
<td>5</td>
<td>C</td>
<td>5</td>
</tr>
<tr>
<td>G</td>
<td>2</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>H</td>
<td>1</td>
<td>C &amp; E</td>
<td>6</td>
</tr>
<tr>
<td>J</td>
<td>4</td>
<td>E</td>
<td>8</td>
</tr>
<tr>
<td>K</td>
<td>6</td>
<td>H</td>
<td>3</td>
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<tr>
<td>L</td>
<td>3</td>
<td>J</td>
<td>2</td>
</tr>
<tr>
<td>M</td>
<td>2</td>
<td>K &amp; L</td>
<td>4</td>
</tr>
<tr>
<td>N</td>
<td>4</td>
<td>G &amp; K</td>
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<tr>
<td>O</td>
<td>2</td>
<td>N &amp; M</td>
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</tr>
<tr>
<td>P</td>
<td>2</td>
<td>O</td>
<td>2</td>
</tr>
</tbody>
</table>

1) Draw the network. (AoA or AoN)
2) Calculate all the total floats
3) Calculate all the free floats
4) Mark the critical path on the diagram
A.25

1) See AoN network
2) Total floats are: \( C = 1, \ D = 1, \ F = 1, \ G = 1, \ J = 2, \ L = 2, \ M = 2 \)
3) Free floats are: \( D = 1, \ G = 1, \ M = 2 \)
4) The critical path is activities A-B-E-H-K-N-O-P

Reference: PMP&C, Chapter 22, & bullet point answers, No. 3.2

Q.26  *Using the information from question 25,*

1) *Draw the bar chart from the network*
2) *Draw the histogram for the resources*
3) *Draw the cumulative resource “S” curve*

A.26

1) See sheet 2
2) See sheet 2
3) See sheet 2

Reference: PMP&C, Chapter 30, & bullet point answers, No. 3.2
QUESTION 26

ANSWER

Bar chart

Histogram

'S' curve
Q.27  A project consisting of 6 activities (A to F), the budgets, the % complete and the actual recorded costs for a specific point in time are as shown below:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Budget £</th>
<th>% complete</th>
<th>Actual Cost £</th>
<th>Earned Value £</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>70</td>
<td>90</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>40</td>
<td>80</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>80</td>
<td>70</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>60</td>
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<td>40</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>20</td>
<td>10</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>80</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>350</td>
<td></td>
<td>240</td>
<td></td>
</tr>
</tbody>
</table>

1) Calculate the Earned Value for each activity
2) Calculate the overall % of the project
3) Calculate the CPI (or efficiency) of the project
4) Calculate the estimated final cost

A.27

1) Earned values are: A = 63, B = 32, C = 56, D = 12, E = 2, F = 4, Total = 169
2) Overall % complete = EV/Budget = 169/350 = 0.48
3) CPI or Efficiency = EV/Actual Cost = 169/240 = 0.70 or 70%
4) Estimated final cost = Budget/CPI = 350/0.70 = 500 or Actual Cost/% complete = 240/0.48 = 500

Reference: PMP&C, Chapter 32, & bullet point answers, No. 3.6

Q.28  A project has an original budget of £600,000 and after the first 4 months of a 12 months planned project time, the Scheduled Costs, Actual Costs and Earned Values are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Month 1 £</th>
<th>Month 2 £</th>
<th>Month 3 £</th>
<th>Month 4 £</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled Cost</td>
<td>32 000</td>
<td>60 000</td>
<td>150 000</td>
<td>240 000</td>
</tr>
<tr>
<td>Actual Costs</td>
<td>35 000</td>
<td>70 000</td>
<td>160 000</td>
<td>250 000</td>
</tr>
<tr>
<td>Earned Value</td>
<td>30 000</td>
<td>50 000</td>
<td>140 000</td>
<td>230 000</td>
</tr>
</tbody>
</table>
1) **Draw the three curves, Scheduled, Actual & Earned Value**

2) **Calculate the Cost Variance for month 4**

3) **Calculate the Schedule Variance (cost based) for month 4**

4) **Find the Schedule Variance (time based) for month 4**

5) **Calculate the CPI for month 4**

6) **Calculate the SPI (cost based) for month 4**

7) **Find the SPI (time based) for month 4**

8) **Calculate the estimated final cost of the project**

9) **Calculate the estimated final completion time of the project**

**A.28**

1) See diagram

2) Cost variance for month 4 = EV – Actual = 230000 – 250000 = –20000

3) Schedule variance for month 4 = EV – Scheduled = 230000 – 240000 = –10000

4) See diagram

5) CPI (cost) for month 4 = EV/Actual = 230000/250000 = 0.92

6) SPI (cost) for month 4 = EV/Scheduled = 230000/240000 = 0.96

7) See diagram

8) Final cost of project = Budget/CPI = 600000/0.92 = 652 174

9) Estimated final time = Total planned time/SPI = 12 months/0.96 = 12.5 months

Reference: PMP&C, Chapter 32, & bullet point answers, No. 3.6
Q.29 With an original investment of £35,000 and the net returns given below, two projects, A and B are competing for the funds.

(Obtain the discount factor from the table in the book: “Project Management, Planning and Control”, page 22)

<table>
<thead>
<tr>
<th>Discount Rate</th>
<th>Project A</th>
<th>Project B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>14%</td>
<td>14%</td>
</tr>
<tr>
<td>1</td>
<td>£12,000</td>
<td>£10,000</td>
</tr>
<tr>
<td>2</td>
<td>£14,000</td>
<td>£12,000</td>
</tr>
<tr>
<td>3</td>
<td>£16,000</td>
<td>£16,000</td>
</tr>
<tr>
<td>4</td>
<td>£12,000</td>
<td>£14,000</td>
</tr>
<tr>
<td>5</td>
<td>£10,000</td>
<td>£12,000</td>
</tr>
<tr>
<td>Total</td>
<td>£64,000</td>
<td>£64,000</td>
</tr>
</tbody>
</table>

Which is the more attractive investment?

What is the payback period for A and B?

A.29

<table>
<thead>
<tr>
<th>Year</th>
<th>Project A</th>
<th>Project A cumulative</th>
<th>Project B</th>
<th>Project B cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>£12,000</td>
<td>£(35,000)</td>
<td>£(35,000)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>£14,000</td>
<td>£(23,000)</td>
<td>£10,000</td>
<td>£(25,000)</td>
</tr>
<tr>
<td>2</td>
<td>£16,000</td>
<td>£(9,000)</td>
<td>£12,000</td>
<td>£(10,000)</td>
</tr>
<tr>
<td>3</td>
<td>£16,000</td>
<td>£7,000</td>
<td>£16,000</td>
<td>£6,000</td>
</tr>
</tbody>
</table>

On the basis of the NPV, the cash flow of Project A gives the better investment.
Therefore the payback of both projects based on the undiscounted cash flow is between 2 and 3 years. In both cases the difference in cash flow between year 2 and year 3 is £16,000. Therefore, for project A the payback is $2 + (9,000/16,000)12 = 2$ years and 6.75 months and for project B the payback is $2 + (10,000/16,000)12 = 2$ years and 7.50 months.

Reference: PMP&C, Chapter 6

Q.30 With an original investment of £50,000
What is the IRR?
(Obtain the discount factors from the table in the book: “Project Management, Planning and Control”, page 22)

<table>
<thead>
<tr>
<th>Discount Rate Year</th>
<th>Net Return</th>
<th>10%</th>
<th>12%</th>
<th>16%</th>
<th>18%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>£12,000</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>3</td>
<td>£14,000</td>
<td></td>
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<tr>
<td>4</td>
<td>£16,000</td>
<td></td>
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<td></td>
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<tr>
<td>5</td>
<td>£16,000</td>
<td></td>
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<tr>
<td>Total</td>
<td>£62,000</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

A.30

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Return</th>
<th>10%</th>
<th>12%</th>
<th>16%</th>
<th>18%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DF</td>
<td>DCF</td>
<td>DF</td>
<td>DCF</td>
</tr>
<tr>
<td>0</td>
<td>(£50,000)</td>
<td>£</td>
<td></td>
<td>£</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>£12,000</td>
<td>.909</td>
<td>10,908</td>
<td>.895</td>
<td>10,740</td>
</tr>
<tr>
<td>2</td>
<td>£14,000</td>
<td>.826</td>
<td>11,564</td>
<td>.797</td>
<td>11,158</td>
</tr>
<tr>
<td>3</td>
<td>£14,000</td>
<td>.751</td>
<td>10,514</td>
<td>.712</td>
<td>9,968</td>
</tr>
<tr>
<td>4</td>
<td>£16,000</td>
<td>.683</td>
<td>10,928</td>
<td>.636</td>
<td>10,176</td>
</tr>
<tr>
<td>5</td>
<td>£16,000</td>
<td>.621</td>
<td>9,936</td>
<td>.567</td>
<td>9,072</td>
</tr>
<tr>
<td>Total</td>
<td>£62,000</td>
<td>53,850</td>
<td>51,114</td>
<td>46,168</td>
<td>43,990</td>
</tr>
<tr>
<td>Deduct Investment</td>
<td>−50,000</td>
<td>−50,000</td>
<td>−50,000</td>
<td>−50,000</td>
<td></td>
</tr>
<tr>
<td>NPV</td>
<td></td>
<td>3,850</td>
<td>1,114</td>
<td>−3,832</td>
<td>−6,010</td>
</tr>
</tbody>
</table>

When NPV = 0, IRR = 12.8% approx.
Q.31  Form the following network and resource table,

a) Draw a bar chart and resource histogram of the activities.

b) Show how the histogram can be smoothed to ensure that the resources in any week do not exceed 7

Reference: PMP&C, Chapter 6
By utilising the 1 week float of activity G and moving it 1 week forward to start in week 9, the resources in week 8 are reduced from 9 to 6. This increases the resources in week 14 from 2 to 5.

Reference: PMP&C, Chapter 21 and 30

Q.32 The following table shows the duration’s (in weeks), dependencies and weekly resources units for eight activities marked A to H.

a) Draw the network (AoA or AoN) to calculate the total floats
b) Draw the bar chart
c) Smooth out the activity bars to limit the resource usage in any week to 10 units

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Dependency</th>
<th>Weekly resource units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3</td>
<td>–</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>A &amp; E</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>C &amp; F &amp; H</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>6</td>
<td>E</td>
<td>4</td>
</tr>
<tr>
<td>G</td>
<td>4</td>
<td>E</td>
<td>2</td>
</tr>
<tr>
<td>H</td>
<td>3</td>
<td>G</td>
<td>1</td>
</tr>
</tbody>
</table>
a) The total floats are as follows:
   Activity E = 1, Activity F = 2, Activity G = 1, Activity H = 1
   Activities A, B, C & D are on the critical path and have therefore 0 float

![Network Diagram]

b) To limit the resources to 10 units in any week,
   a) Take up the one week float of activity G by starting it in week 3
   b) Take up the one week float of activity H by starting it in week 7
   This will reduce the resource usage in the 3rd week from 12 to 10
c) Alternatively, activity F could have been moved forward 1 week by taking up 1 week of its 2 week float

Reference: PMP&C, Chapter 30

Q.33 The table below shows the outflow and inflow (values in $1,000) of a small project.

a) Draw the cash flow curves
b) Comment on the cash flow of this project
c) What could be done to ensure a positive cash flow during the period of the project

<table>
<thead>
<tr>
<th>Months</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outflow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Material</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Labour</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Overheads</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Inflow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payments</td>
<td>–</td>
<td>14</td>
<td>22</td>
<td>20</td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>
Outflow
Equipment  4  5  5  6  3  2
Material   3  6  6  8  3  2
Labour     2  2  3  3  2  1
Overheads  1  1  1  1  1  1
Total      10 14 15 18  9  6
Cumulative 10 24 39 57 66 72

Inflow
Payments   –  14 22 20 12 20
Cumulative –  14 36 56 68 88

a)

b) The cash net flow is negative for the first four months so that the project is not completely self funding.
c) To make the net cash flow positive every month, an advanced payment of $12,000 should be negotiated which is repaid at the end of the project period. This may incur a small interest charge or other concession such as an extended guarantee period.

Adjusted net (inflow – outflow) cash flow with advance payment of $12,000
Net flow: 12 14 22 20 12 8
Cumulative: 12 26 48 68 80 88

Reference: PMP&C, Chapter 31 & bullet point answers, No. 3.4