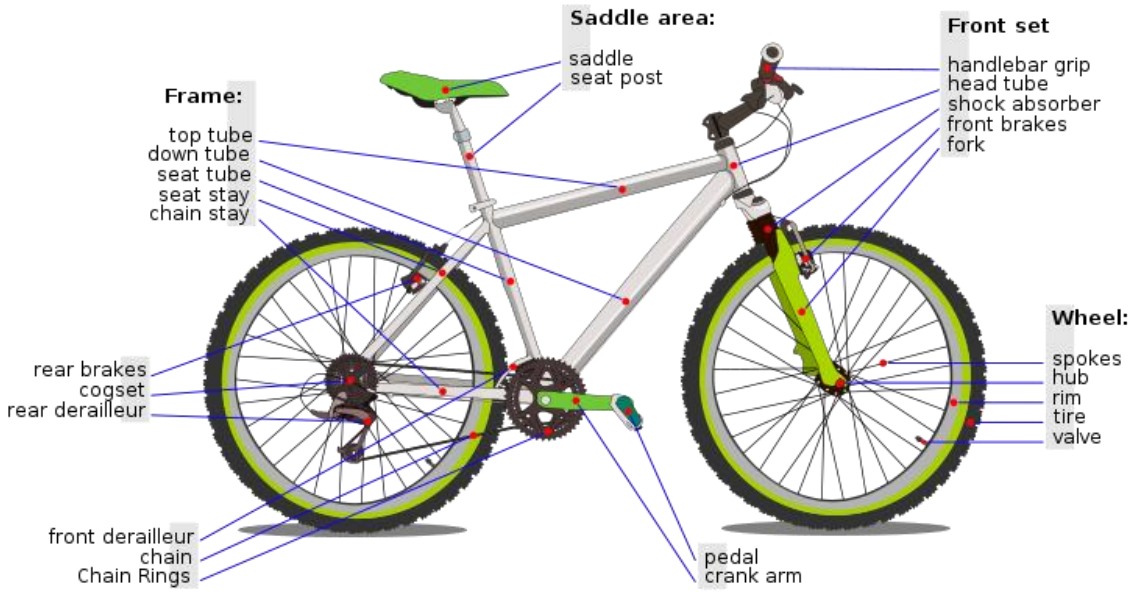
Main components, sub-assemblies and parts of the bicycle

The bicycle is the most efficient self-powered means of transportation in terms of energy a person must expend to travel a given distance. A human traveling on a bicycle at low to medium speeds of around 10–15 mph (15–25 km/h) uses only the energy required to walk. Air drag, which is proportional to the square of speed, requires dramatically higher power outputs as speeds increase. If the rider is sitting upright, the rider's body creates about 75% of the total drag of the bicycle/rider combination.

Components, sub-assemblies and parts of the bicycle:

Component Outlook



The great majority of today's bicycles have a frame with upright seating which looks much like the first chain-driven bike. Such upright bicycles almost always feature the diamond frame, a truss consisting of two triangles: the front triangle and the rear triangle. The front triangle consists of the head tube, top tube, down tube and seat tube. The head tube contains the headset, the set of bearings that allows the fork to turn smoothly for steering and balance. The top tube connects the head tube to the seat tube at the top, and the down tube connects the head tube to the bottom bracket. The rear triangle consists of the seat tube and paired chain stays and seat stays. The chain stays run parallel to the chain, connecting the bottom bracket to the rear fork ends. The seat stays connect the top of the seat tube (at or near the same point as the top tube) to the rear fork ends.

Historically, women's bicycle frames had a top tube that connected in the middle of the seat tube instead of the top, resulting in a lower stand over height at the expense of compromised structural integrity, since this places a strong bending load in the seat tube, and bicycle frame members are typically weak in bending.

Drive train and gearing:

The drivetrain begins with pedals which rotate the cranks, which are held in axis by the bottom bracket. Most bicycles use a chain to transmit power to the rear wheel. A relatively small number of bicycles use a shaft drive to transmit power. A very small number of bicycles (mainly single-speed bicycles intended for short-distance commuting) use a belt drive as an oil-free way of transmitting power.

Since cyclists' legs are most efficient over a narrow range of pedaling speeds (cadence), a variable gear ratio helps a cyclist to maintain an optimum pedaling speed while covering varied terrain. As a first approximation, utility bicycles often use a hub gear with a small number (3 to 8) of widely spaced gears, road bicycles and racing bicycles use derailleur gears with a moderate number (10 to 22) of closely spaced gear ratios, while mountain bicycles, hybrid bicycles, and touring bicycles use dérailleur gears with a larger number (15 to 33) of moderately spaced gear ratios, often including an extremely low gear ("granny gear") for climbing steep hills.

Different gears and ranges of gears are appropriate for different people and styles of cycling. Multi-speed bicycles allow gear selection to suit the circumstances: a cyclist could use a high gear when cycling downhill, a medium gear when cycling on a flat road, and a low gear when cycling uphill. In a lower gear every turn of the pedals leads to fewer rotations of the rear wheel. This allows the energy required to move the same distance to be distributed over more pedal turns, reducing fatigue when riding uphill, with a heavy load, or against strong winds. A higher gear allows a cyclist to make fewer pedal turns to maintain a given speed, but with more effort per turn of the pedals.

With a chain drive transmission, a chaining attached to a crank drives the chain, which in turn rotates the rear wheel via the rear sprocket(s) (cassette or freewheel). There are four gearing options: two-speed hub gear integrated with chain ring, up to 3 chain rings, up to 11 sprockets, hub gear built in to rear wheel (3-speed to 14-speed). The most common options are either a rear hub or multiple chain rings combined with multiple sprockets (other combinations of options are possible but less common).

With a shaft drive transmission, a gear set at the bottom bracket turns the shaft, which then turns the rear wheel via a gear set connected to the wheel's hub. There is some small loss of efficiency due to the two gear sets needed. The only gearing option with a shaft drive is to use a hub gear.

Steering and seating:

The handlebars turn the fork and the front wheel via the stem, which rotates within the headset. Three styles of handlebar are common. Upright handlebars, the norm in Europe and elsewhere until the 1970s, curve gently back toward the rider, offering a natural grip and comfortable upright position. Drop handlebars "drop" as they curve forward and down, offering the cyclist best braking power from a more aerodynamic "crouched" position, as well as more upright positions in which the hands grip the brake lever mounts, the forward curves, or the upper flat sections for increasingly upright postures. Mountain bikes generally feature a 'straight handlebar' or 'riser bar' with varying degrees of sweep backwards and centimeters rise upwards, as well as wider widths which can provide better handling due to increased leverage against the wheel.

Saddles also vary with rider preference, from the cushioned ones favored by short-distance riders to narrower saddles which allow more room for leg swings. Comfort depends on riding position. With comfort bikes and hybrids, cyclists sit high over the seat, their weight directed down onto the saddle, such that a wider and more cushioned saddle is preferable. For racing bikes where the rider is bent over, weight is more evenly distributed between the handlebars and saddle, the hips are flexed, and a narrower and harder saddle is more efficient. Differing saddle designs exist for male and female cyclists,

accommodating the genders' differing anatomies, although bikes typically are sold with saddles most appropriate for men.

A recumbent bicycle has a reclined chair-like seat that some riders find more comfortable than a saddle, especially riders who suffer from certain types of seat, back, neck, shoulder, or wrist pain. Recumbent bicycles may have either under-seat or over-seat steering.

Brakes:

Modern bicycle brakes may be: rim brakes, in which friction pads are compressed against the wheel rims; internal hub brakes, in which the friction pads are contained within the wheel hubs; or disc brakes, with a separate rotor for braking. Disc brakes are more common for off-road bicycles, tandems and recumbent bicycles than on road-specific bicycles.

With hand-operated brakes, force is applied to break levers mounted on the handlebars and transmitted via Bowden cables or hydraulic lines to the friction pads. Track bicycles do not have dedicated brakes. Brakes are not required for riding on a track because all riders ride in the same direction around a track which does not necessitate sharp deceleration. Track riders are still able to slow down because all track bicycles are fixed-gear, meaning that there is no freewheel. Without a freewheel, coasting is impossible, so when the rear wheel is moving, the crank is moving. To slow down, the rider applies resistance to the pedals – this acts as a braking system which can be as effective as a friction-based rear wheel brake, but not as effective as a front wheel brake.

Suspension

Bicycle suspension refers to the system or systems used to suspend the rider and all or part of the bicycle. Bicycle suspensions are used primarily on mountain bicycles, but are also common on hybrid bicycles, and can even be found on some road bicycles, as they can help deal with problematic vibration. Suspension is especially important on recumbent bicycles, since while an upright bicycle rider can stand on the pedals to achieve some of the benefits of suspension, a recumbent rider cannot.

Wheels and tires

The wheel axle fits into fork ends in the frame and forks. A pair of wheels may be called a wheelset, especially in the context of ready-built "off the shelf", performance-oriented wheels.

Main article: Bicycle tire

Tires vary enormously. Skinny 18 to 25 millimeters wide, road-racing tires may be completely smooth, or (slick). On the opposite extreme, off-road tires are 38 to 64 millimeters wide and usually have a deep tread for gripping in muddy conditions or metal studs for ice.

Accessories, repairs, and tools:

Some components, which are often optional accessories on sports bicycles, are standard features on utility bicycles to enhance their usefulness and comfort. Mudguards, or fenders, protect the cyclist and moving parts from spray when riding through wet areas and chainguards protect clothes from oil on the chain while preventing clothing from being caught between the chain and crankset teeth. Kick stands keep a bicycle upright when parked, while a bike lock will help prevent it from being stolen. Front-mounted baskets for carrying goods are often used. Luggage carriers and panniers mounted above the rear tire can be used to carry equipment or cargo. Parents sometimes add rear-mounted child seats and/or an auxiliary saddle fitted to the crossbar to transport children.

Toe-clips and toestraps and clipless pedals help keep the foot locked in the proper position on the pedals, and enable the cyclist to pull as well as push the pedals—although not without their hazards, e.g. may lock foot in when needed to prevent a fall. Technical accessories include cyclocomputers for measuring speed, distance, heart rate, GPS data etc. Other accessories include lights, reflectors, security locks, mirror, water bottles and cages, and bell.

Bicycle helmets may help reduce injury in the event of a collision or accident, and a certified helmet is legally required for some riders in some jurisdictions. Many cyclists carry tool kits. These may include a tire patch kit (which, in turn, may contain any combination of a hand pump or CO2 Pump, tire levers, spare tubes, self-adhesive patches, or tube-patching material, an adhesive, a piece of sandpaper or a metal grater (for roughing the tube surface to be patched),[23][24] and sometimes even a block of French chalk.), wrenches, hex keys, screwdrivers, and a chain tool. There are also cycling specific multi-tools that combine many of these implements into a single compact device. More specialized bicycle components may require more complex tools, including proprietary tools specific for a given manufacturer.

Parts:

Some major parts for a bicycle includes with:

Axle, Bar ends, Bar plugs aka end caps, Bearing, Belt-drive, Basket, Bottle cage, Bottom bracket, Brake, Braze-on, Cable guide, Cable, Cartridge bearing, Cassette, Chain, Chainring, Chainstay, Cogset, Cone, Crankset, Cotter, Coupler, Cup, Cyclocomputer, Derailleur hanger, Derailleur, Down tube, Dropout (bicycle part), Dustcap, Dynamo, Eyelet 1, Electronic Gear-Shifting System, Fairing, Fender, Ferrule, Fork, Fork end, Frame, Freehub, Freewheel, Hanger, Handlebar tape, Handlebar, Head badge, Head tube, Headset or head set, Hood, Hub, Hub dynamo, Indicators, Inner tube, Jockey wheel, Kickstand, Locknut, Lockring, Lug, Luggage carrier, Nipple, Pannier, Pedal, Quick release, Rack, Reflector, Rotor, Safety levers, extension levers, and interrupt brake levers, Saddle, Seat, Seat Rails, Seat lug, Seat tube, Seat bag, Seatpost, Seatstay, Shaft-drive, Shifter, Shock absorber, Skirt guard or coatguard, Spindle, Spoke, Steering tube, Stem, Tire, Toe clips, Top tube, Valve stem or simply valve, Wheel

Possible layout of the assembly plant: One of the best plant for assemble bicycle is automated Conveyor Systems Simulation Modeling and Analysis for Major Bicycle Producer.

As part of a lean manufacturing strategy, this major producer of bicycles was designing a new focused factory for 24” and 26” bikes. An automated overhead power and free conveyor system was identified as the most appropriate conveyance method. The new $15,000,000 flex paint shop design included 14 booths, over two miles of conveyor with an empty carrier re-circulator and selectivity banks, and 150 decision points with automatic tracking and routing of more than 3500 carriers. The system was designed to attain a maximum throughput of 650 carriers/hour and net 6500 bicycles per day. Due to the sheer size, complexity and unpredictability of this large scale paint system manual/static analysis was not practical. Computer simulation modeling and analysis was selected as the most appropriate tool available for testing and evaluating the dynamic behavior of the paint conveyor system design prior to making substantial financial commitments.

The goal was to build an accurate, data driven model of the proposed conveyor design that reflects real world production capabilities and would answer three fundamental questions: 1)Will the new conveyor system design work? 2) How well will it work? 3) What will it take to make it work more efficiently and effectively?

The model was constructed using the WITNESS animated graphical simulation software. Since the client’s industrial engineers had practically no simulation experience, PES had an important secondary

goal of training their engineers in the use of the simulation software, project methodology as well as in the specifics of their model to perform further what-if experiments. Using our proven interactive approach, PES worked directly with the client to collect data, prepare a detailed functional specification, convert existing AutoCAD layout file to WITNESS, construct and validate the model, conduct systems analysis, review progress, document and present results.

The completed model was used to identify several major bottlenecks in product flow and test and evaluate conveyor design revisions to ensure that blockages were alleviated and target throughput was achievable. The model also highlighted potential gridlock conditions and allowed the team to fine tune control strategies, predict carrier requirements and size the empty carrier selectivity banks. Our analysis illustrated the potential for 25%+ improvement in throughput capability of the base design. The result was a highly flexible and efficient conveyor system design, pre-tested for a fraction of the total capital costs. Furthermore, our client's industrial engineers with limited prior simulation exposure have been thoroughly trained by PES and are now able to use the model independently to perform ongoing analysis.

Bicycle Design Job Criteria

Work arrangement (or rearrangement) aimed at reducing or overcoming job dissatisfaction and employee alienation arising from repetitive and mechanistic tasks. Through job design, organizations try to raise productivity levels by offering non-monetary rewards such as greater satisfaction from a sense of personal achievement in meeting the increased challenge and responsibility of one's work. Job enlargement, job enrichment, job rotation, and job simplification are the various techniques used in a job design exercise.

Job Design is affected by 3 categories of factors:

1. Organizational Factors: The organizational factors that affect job design are characteristics of task, work flow, ergonomics and work practices.
2. Environmental Factors: Environmental factors affect job design. Environmental factors include employee abilities & availability and Social & Cultural expectations.
3. Behavioral Factors: Behavioral factors are related to human needs and they need to be satisfied properly.

Techniques of Job Design:

1. Job Simplification.
2. Job Rotation
3. Job Enlargement
4. Job Enrichment

To discuss in detail for a bicycle design of Job first need to prepare sketches of ideas, detailed drawings, illustrations, artwork, or blueprints, using drafting instruments, paints and brushes, or computer-aided design equipment. Direct and coordinate the fabrication of models or samples and the drafting of working drawings and specification sheets from sketches. Modify and refine designs, using working models, to conform to customer specifications, production limitations, or changes in design trends. Coordinate the look and function of product lines. And for these few element that may be essential to perform this as better to work in real frame work-

1. Education in particular field
2. Experience for design
3. Experience for co-ordinate
4. Share the knowledge with upgrade platform

Raw material Demand and Supply:

Raw materials are a very important factor for production especially for a Bicycle company. The supply of the materials should have depend on the production cycle, few factory may have produce one materials within a cycle of time and then go for another cycle the cycle per shift for produce the product may be the creating idea “how much you need to produce per day”? The best idea for supply the raw materials is a chain of supply not a large quantity for available product rather then get some idea for those available market share, price index for the materials and some other environmental issues. And most important part of the supply raw materials is “The policy holding the company for the raw material production”.

Another important part is JIT (Just-in-time). JIT is an inventory strategy that strives to improve a business's return on investment by reducing in-process inventory and associated carrying costs. JIT production method is also called the Toyota Production System. To meet JIT objectives, the process relies on signals between different points in the process, which tell production when to make the next part. Signals are usually 'tickets' but can be simple visual signals, such as the presence or absence of a part on a shelf. Implemented correctly, JIT focuses on continuous improvement and can improve a manufacturing organization's return on investment, quality, and efficiency. To achieve continuous improvement key areas of focus could be flow, employee involvement and quality.

The most profitable idea that may be the best criteria for a manufacturing company is “No inventory (raw material and finished goods) and minimal WIP”. It is the policy holing the best idea how to manage your capital, productivity and people. It is only possible for design the process, sketch it with in a cycle of time and make that possible when all “P” belong to profitability and progress.

Sequence the work:

The term workflow Or the sequence the work is ore commonly used in particular industries, such as printing, and professional domains, where it may have particular specialized meanings. 1. Processes: A process is a more specific notion than workflow, and can apply to physical or biological processes, for instance. In the context of concepts surrounding work, a process may be distinguished from a workflow by the fact that it has well-defined inputs, outputs and purposes, while the

notion of workflow may apply more generally to any systematic pattern of activity (such as all processes occurring in a machine shop).

2. Planning and scheduling: A plan is a description of the logically necessary, partially-ordered set of activities required to accomplish a specific goal given certain starting conditions. A plan, when augmented with a schedule and resource allocation calculations, completely defines a particular instance of systematic processing in pursuit of a goal. A workflow may be viewed as an (often optimal or near-optimal) realization of the mechanisms required to execute the same plan repeatedly.

3. Flow control is a control concept applied to workflows to divert from static control concepts applied to stock, that simply managed the buffers of material or orders, to a more dynamic concept of control, that manages the flow speed and flow volumes in motion and in process. Such orientation to dynamic aspects is the basic foundation to prepare for more advanced job shop controls, as just-in-time or just-in-sequence.

4. In transit visibility is a monitoring concept that applies to transported material as well as to work in process or work in progress, i.e., workflows.

Mainly for a Mechanism shop/factory follows the sequence and as a better manager I would like to follow this way.

Work Shop:

> Delivery of 4500/month for the three months otherwise there will be penalty. It the bicycles are late the following is the penalties - £2.00 for Children's bicycle, £4.00 for adult's bicycle and £5.00 for sports bicycle.

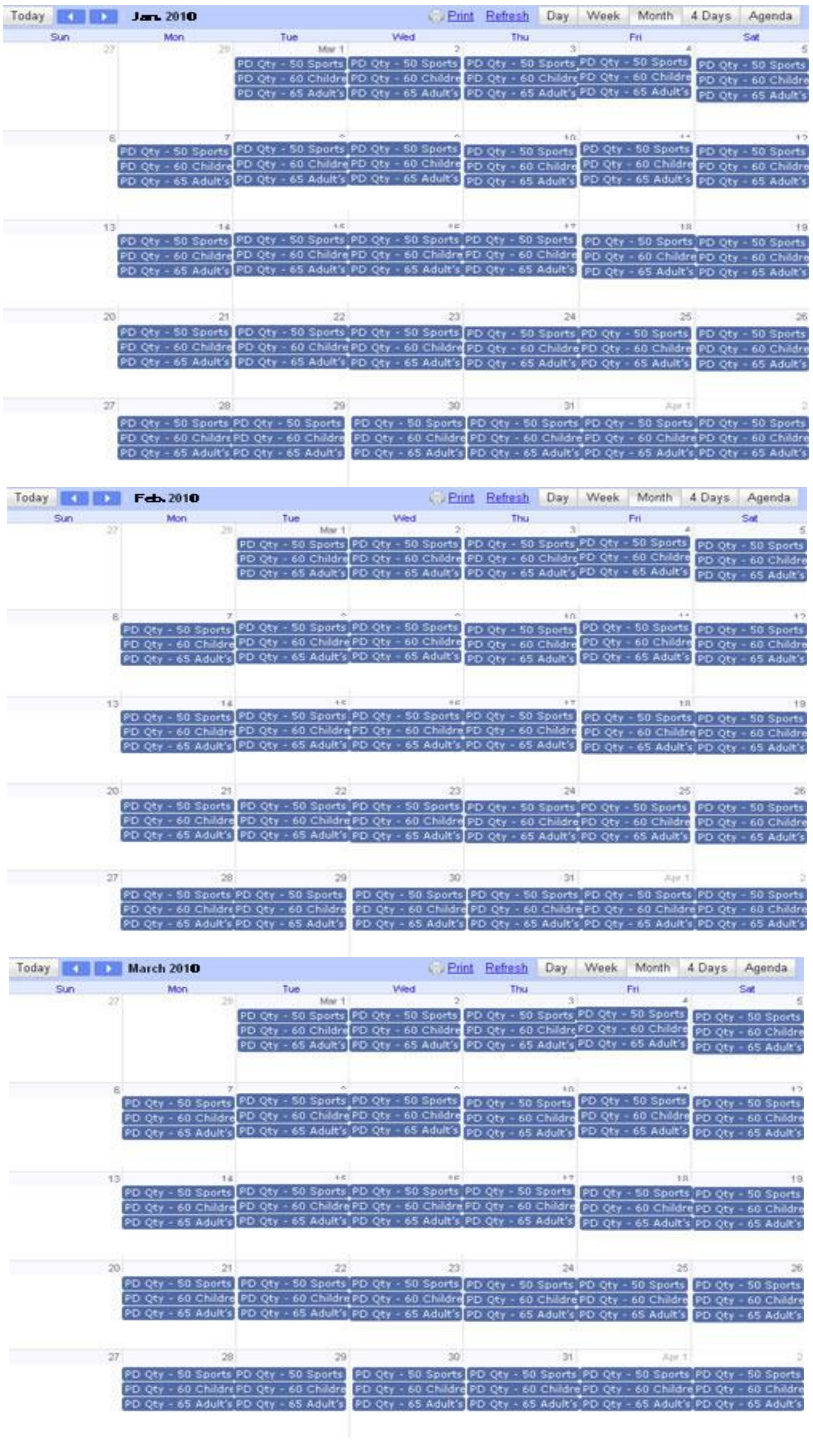
Question: For 'peak' time Christmas and extra shift is being considered. Discuss whether it is profitable or not. You cannot have an extra shift for more than two weeks. And cannot employee more fulltime staff.

Answer: Full time employee is rather skilled and operates smoothly for any production company. For travelling company, marketing company the part time are better profitable but not for any manufacturing shops. But here we can found a little different scene because of the penalties for £2.00 for Children's bicycle, £4.00 for adult's bicycle and £5.00 for sports bicycle.

In that case in a Christmas the full time more employee are not available and also many of them should have some leave so no other way to skip the penalty without hiring part timer employee to survive the situation from present.

Question: Sketch the output for each calendar day for the three months on a graph – one graph for each month. The least 'bull whip' affects the better.

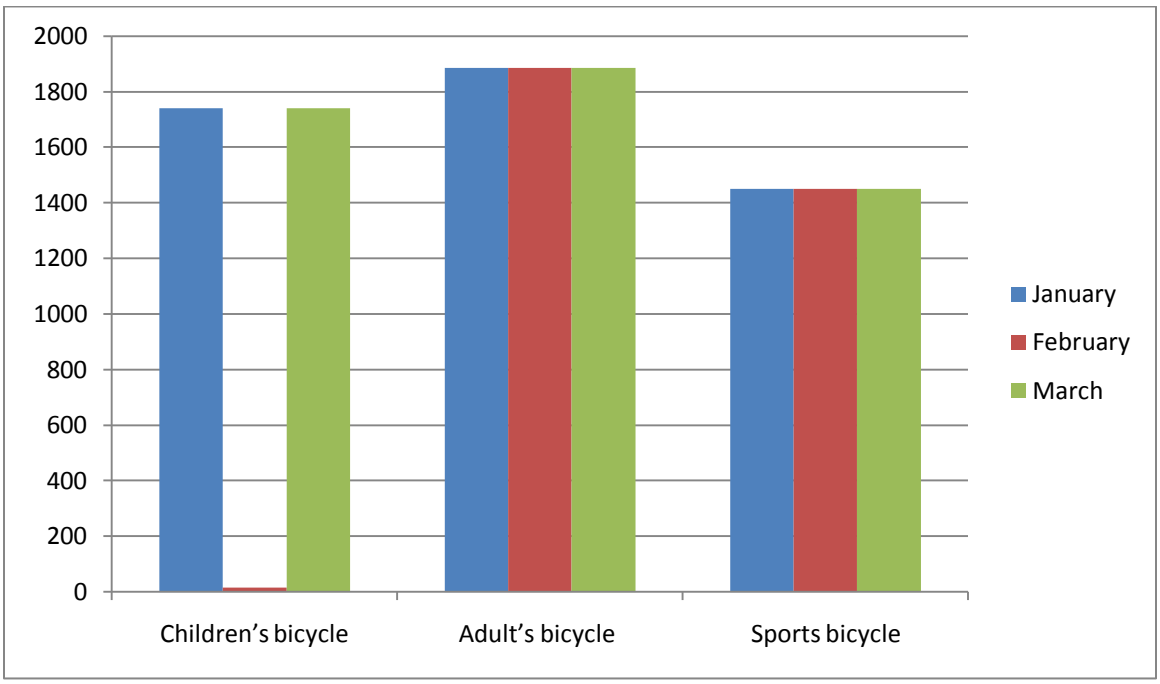
Answer: Check out the chart showing below –



This is a chart showing for March 2010. It shows Production for Sports production for each day 50 Children 60 and adult 65. Total 175 per day without weekend it is assumed that in total for the month of January = 5075.

Note: This product is a sample that may indicate the few more quantity without any risk.

This account of dimension is perfectly with the limited machineries and employee. If this maintain for without any interruption and work with a "**bull whip**" affect this may possible to achieve the target without risk that may cause a great penalty.



Here is a graph showing that In the month of February a disaster for Fire cause the all a large damage for Children bicycle parts (Set) damage and that is the reason it may not produce a lot as per expected. But being we have produced the maximum possible number of product it cause no problem and produced the quantity we have required.

Questions: If the company makes; Children's - £20, Adult's - £40 and Sport's- £45 net profit per bike, would the company make profit in these three months? You should show clear workings, for each of these questions.

Answer: It is clearly observe that if the profit margin for Children's - £20, Adult's - £40 and Sport's- £45 per bike then it may show the right marginal profit. And this may cause a good profit per by cycle as per expected. In total profit will be better, because we can see the mostly produced bicycle will be adult bicycle and for sports are in quantity number two where as we can see that the maximum profit comes from adult bicycle thus it is rather profitable then more comes from Children but best profitability options is adult bicycle.

Comments: This will be better then the required profit margin.